APPENDIX A

LABORATORY CERTIFICATION AND QUALITY ASSURANCE MANUAL, TEST AMERICA, INC.

CD COPY ONLY

LABORATORY QUALITY MANUAL

Aerotech Environmental Laboratories

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Signature Approvals:

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STL VISION & MISSION

Vision

STL will be the recognized industry leader for enviromental testing.

Mission

Through the innovation and dedication of our people, together with the quality of our systems, we will deliver levels of performance that delight our clients, retain the confidence of our stakeholders and enable the profitable growth of our business.

1.0 Introduction, Purpose, and Scope

1.1 AEL Overview

Aerotech Laboratories, Inc., d/b/a Aerotech Environmental Laboratories (AEL) is owned by Aerotech Holdings, Inc. Ownership of Aerotech Holdings, Inc. was transferred to TestAmerica Holdings, Inc. TestAmerica Holdings, Inc. is known as STL and TestAmerica; a major group of U.S. based companies.

AEL is a full-service environmental laboratory that provides quality comprehensive and integrated professional analytical services effectively and efficiently. A broad range of environmental, and industrial hygiene testing services are offered that span a variety of matrices, including aqueous, solid, drinking water, waste, air, and industrial hygiene samples. Specialty capabilities include air toxics testing, mixed waste testing, Inductively Coupled Plasma/MS (ICP/MS), and Liquid Chromatography/MS (LC/MS).

Associated with this activity are services to assure client requirements are known, communicated and satisfactorily addressed, and a deliverables package presenting the analytical results. The laboratory provides expert personnel for supervision, technical consultation, and project review for effective planning and implementation of analytical assignments.

AEL operates under the regulations and guidelines of the following federal programs:

- Clean Air Act (CAA)
- Clean Water Act (CWA)
- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)
- National Institute for Occupational Safety and Health (NIOSH)
- National Pollutant, Discharge, and Elimination System (NPDES)
- Occupational Safety and Health Administration (OSHA)
- Resource Conservation and Recovery Act (RCRA)
- Safe Drinking Water Act (SDWA)
- Toxic Substances Control Act (TSCA)

AEL also provides services under various state and local municipal guidelines. A current table of the certifications for the Phoenix laboratory is below in Table 1. Copies of the current Arizona license and parameter list are included as Appendixes 4 and 5, respectively. Appendixes 6 and 7 include Phoenix's AIHA Certification and Scope of Accreditation. Copies of the certifications are available from the laboratory upon request.

Table 1. AEL Certifications and Accreditations

Agency	Analytes
Arizona	SDWA inorganics, microbiology and organics CWA inorganics, microbiology and organics RCRA inorganics and organics AIR organics
ORELAP (NELAP)	SDWA - Perchlorate RCRA inorganics and organics AIR inorganics and organics
New York ELAP (requested)	AIR - Mercury in Air
American Industrial Hygiene Association (AIHA)	Metals, formaldehyde, organic solvents and passive monitors
U.S. Department of Agriculture	Soil Permit and Compliance Agreement for the import of foreign soil

1.2 Quality Assurance Policy

It is AEL's policy to:

- Provide high quality, consistent, and objective environmental testing services that meet all federal, state, and municipal regulatory requirements.
- Ensure that the analytical data is of known and acceptable precision and accuracy, as prescribed by the approved method.
- Generate data that are scientifically sound, legally defensible, meet project objectives, and are appropriate for their intended use.
- Ensure employee adherence to quality documentation and implementation of Corporate Policies and Procedures.
- Provide AEL clients with the highest level of professionalism and the best service practices in the industry.
- Build continuous improvement mechanisms into all laboratory, administrative, and managerial activities.
- Maintain a working environment that fosters open communication with both clients and staff and ensures data integrity.

1.3 Management Commitment to Quality Assurance

AEL management is committed to providing the highest quality data and the best service in the environmental testing industry and to continually improve the effectiveness of the management system. To ensure that the data produced and reported by AEL meet the requirements of its clients and comply with the letter and spirit of municipal, state and federal regulations, including ISO/IEC 17025. AEL maintains a quality system that is clear, effective, well communicated, and supported at all levels in the company.

Line organizations verify that specifications are achieved; QA organizations assist and provide oversight and verification of processes through planning, reviews, audits, and surveillances. The quality objectives are derived from this Laboratory Quality Manual (LQM), Standard Operating Procedures (SOPs) and Work Instructions.

1.4 Purpose

The purpose of the LQM is to describe AEL's Quality System and to outline how that system enables all employees to meet the Quality Assurance (QA) policy. This LQM also describes specific QA activities and requirements and prescribes their frequencies. Roles and responsibilities of management and laboratory staff in support of the Quality System are also defined in this LQM.

1.5 Scope

This LQM is specific to AEL's quality systems and laboratory operation's. All other TestAmerica-STL locations have LQMs under the Corporate Quality Management Plan (QMP) or the Corporate QMP itself. The LQM is updated whenever necessary and is reviewed and approved by management at least annually.

The laboratory is committed to ensuring that resources are available and deployed to meet client expectations. This includes gathering project information prior to sample receipt to ensure client expectations will be met with respect to:

- Sampling containers
- Analytical methods employed
- Accuracy and precision

- Reporting limits
- Personnel qualifications, training, and experience
- Calibration and quality control measures employed
- Regulatory requirements
- Report contents
- Supporting documentation, records and evidence
- Review of data

1.6 Servicing

Project Managers are the direct client contact and they ensure resources are available to meet project requirements. Although Project Managers do not have direct reports or staff in production, they coordinate opportunities and work with laboratory management and supervisory staff to ensure available resources are sufficient to perform work for the client's project. Project Managers provide a link between the client and laboratory resources.

The laboratory has established procedures for performing and verifying that client servicing meets requirements. Typical services provided are:

- Sample Containers/Supplies
- Project QAP preparation
- Regulatory advisory functions

Regulatory and advisory functions are addressed under the same procedures used for project planning.

2.0 References

The following references were used in preparation of this document and as the basis of the AEL Quality System:

EPA Guidance for Preparing Standard Operating Procedures (SOPs), EPA QA/G-6, US EPA, Office of Environmental Information, March 2001.

EPA Requirements for Quality Management Plans, EPA QA/R-2, US EPA, Office of Environmental Information, March 2001.

EPA Requirements for Quality Assurance Project Plans, EPA QA/R-5, US EPA, Office of Environmental Information, March 2001.

EPA Quality Manual for Environmental Programs, 5360 A1, US EPA Office of Environmental Information, Quality Staff, May 2000.

General Requirements for the Competence of Testing and Calibration Laboratories, ISO/IEC 17025, May 15, 2005.

Good Automated Laboratory Practices, EPA 2185, US EPA, Office of Environmental Information, Resource Management, August 1995.

Laboratory Quality Assurance Program Policy Document, American Industrial Hygiene Association, Effective Date, April 1, 2007.

National Environmental Laboratory Accreditation Conference Standards, EPA/600/R-04/003, US EPA Office of Research and Development, July 2003.

Arizona Administrative Register. Title 9. Health Services, Chapter 14. Department of Health Services. Effective Date, December 5, 2006.

Office of Ground Water and Drinking Water Technical Support Center, EPA. Pub. No. EPA 815-R-05-004, Manual for the Certification of Laboratories Analyzing Drinking Water: Criteria and Procedures Quality Assurance (5th ed. January 2005).

Office of Solid Waste and Emergency Response, EPA, Pub. No. SW-846, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (3rd ed. 1986), as amended by & Update I, July 1992; Update IIA, August 1993; Update II, September 1994; Update IIB, January 1995; Update III, December 1996; Update IIIA, June 1999; and Update IIIB, July 2005), available from National Technical Information Service, 5285 Prt. Royal Rd., Springfield, VA 22161, and at http://www.epa.gov/epaoswer/hazwaste/test/main.htm.

American Public Health Association et al., Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998.

This LQM was written to comply with the National Environmental Laboratory Accreditation Conference (NELAC) standards, the Arizona Rules for Laboratories, ISO/IEC 17025:2005 and the American Industrial Hygiene Association policies. Refer to Table 2 for a cross-section comparison of this LQM to the NELAC standards.

Table 2.

Correlation of LQM Sections with NELAC Section 5.4.2.3 Quality Manual Requirements

NELAC Chapter 5.4.2.3 Quality Manual	LQM Section
a. Quality policy statement, including objectives and commitments, by top management	1.2 Quality Assurance Policy 4.2.1 Objectives of the Quality System
b. Organization and management structure	4.1 Organization and Management
c. Relationship between management, technical operations, support services and the quality systems	4.1.2 Roles and Responsibilities 4.2 Quality System
d. Records retention procedures; document control procedures	4.3 Document Control 4.12.2 Record Retention
e. Job descriptions of key staff and references to job descriptions of other staff	4.1.2 Roles and Responsibilities
f. Identification of laboratory approved signatories	4.1 Organization and Management
g. Procedures for achieving traceability of measurements	5.5 Measurement Traceability
h. List of all test methods under which the laboratory performs its accredited testing	5.3.1 Method Selection
i. Mechanisms for assuring the laboratory reviews all new work to ensure that it has the appropriate facilities and resources before commencing such work	4.4.2 Project-Specific Quality Planning
j. Reference to the calibration and/or verification test procedures used	5.4.3 Equipment Verification and Calibration
k. Procedures for handling submitted samples	4.7.1 Sample Acceptance Policy 5.7 Sample Handling, Transport and Storage
l. Reference to the major equipment and reference measurement standards used as well as the facilities and services used in conducting tests	4.1.1 Laboratory Facilities 5.4.2 Equipment Maintenance 5.4.3 Equipment Verification and Calibration
m. Reference to procedures for calibration, verification and maintenance of equipment	5.4.2 Equipment Maintenance 5.4.3 Equipment Verification and Calibration
n. Reference to verification practices including inter-laboratory comparisons, proficiency testing programs, use of reference materials and internal QC schemes	5.8.1 Proficiency Testing 5.8.2 Control Samples
o. Procedures for feedback and corrective action whenever testing discrepancies are detected, or departures from documented policies and procedures occur	4.9 Control of Non-Conformances 4.10 Corrective Action 4.11 Preventive Action 5.8.5 Permitting Departures from Documented Procedures

Table 2.

Correlation of LQM Sections with NELAC Section 5.4.2.3 Quality Manual Requirements

NELAC Chapter 5.4.2.3 Quality Manual	LQM Section
p. Laboratory management arrangements for exceptionally permitting departures from documented policies and procedures or from standard specifications	4.4.2 Project-Specific Quality Planning 5.8.5 Permitting Departures from Documented Procedures
q. Procedures for dealing with complaints	4.8 Complaints
r. Procedures for protecting confidentiality (including national security concerns) and proprietary rights	4.7.2 Client Confidentiality and Proprietary Rights
s. Procedures for audits and data review	4.13 Internal Audits 4.14 External Audits 5.3.6 Data Reduction and Review
t. Process/procedures for establishing that personnel are adequately experienced in duties they are expected to carry out and are receiving any needed training	5.1.2 Training
u. Reference to procedures for reporting analytical results	5.3.6 Data Review 5.9 Project Reports
v. Table of contents, listing reference, glossaries and appendices	TOC Table of Contents Appendix 1: List of Cited SOPs and Work Instructions

3.0 Terms and Definitions

Accuracy: the degree of agreement between a measurement and true or expected value, or between the average of a number of measurements and the true or expected value.

Audit: a systematic evaluation to determine the conformance to specifications of an operational function or activity.

Batch: environmental samples, which are prepared and/or analyzed together with the same process, using the same lot(s) of reagents. A preparation batch is composed of 1 to 20 environmental samples of a similar matrix, meeting the above mentioned criteria. Where no preparation method exists (example, volatile organics, water) the batch is defined as environmental samples that are analyzed together with the same process and personnel, using the same lots of reagents, not to exceed 20 environmental samples. An analytical batch is composed of prepared environmental samples, extracts, digestates or concentrates that are analyzed together as a group. An analytical batch can include prepared samples originating from various environmental matrices and can exceed 20 samples.

Chain of Custody (COC): A system of documentation demonstrating the physical possession and traceability of samples.

Clean Air Act: legislation in 42 U.S.C. 7401 et seq., Public Law 91-604, 84 Stat. 1676 Pub. L. 95-95, 91 Stat., 685 and Pub. L. 95-190, 91 Stat., 1399, as amended.

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA/Superfund): legislation (42 U.S.C. 9601-9675 et seq., as amended by the Superfund Amendments and reauthorization Act of 1986 (SARA), 42 U.S.C. 9601et seq.

Compromised Sample: a sample received in a condition that jeopardizes the integrity of the results. See Section 4.7.1 for a description of these conditions.

Confidential Business Information (CBI): information that an organization designates as having the potential of providing a competitor with inappropriate insight into its management, operation or products.

Confirmation: verification of the presence of a component using an additional analytical technique. These may include second column confirmation, alternate wavelength, derivatization, mass spectral interpretation, alternative detectors, or additional cleanup procedures.

Corrective Action: action taken to eliminate the causes of an existing non-conformance, defect or other undesirable situation in order to prevent recurrence.

Data Audit: a qualitative and quantitative evaluation of the documentation and procedures associated with environmental measurements to verify that the resulting data are of acceptable quality.

Demonstration of Capability (DOC): procedure to establish the ability to generate acceptable accuracy and precision.

Equipment Blank: a portion of the final rinse water used after decontamination of field equipment; also referred to as Rinsate Blank and Equipment Rinsate.

Document Control: the act of ensuring that documents (electronic or hardcopy and revisions thereto) are proposed, reviewed for accuracy, approved for release by authorized personnel, distributed properly and controlled to ensure use of the correct version at the location where the prescribed activity is performed.

Federal Insecticide, Fungicide and Rodenticide Act (FIFRA): legislation under 7 U.S.C. 135 et seq., as amended.

Federal Water Pollution Control Act (Clean Water Act, CWA): legislation under 33 U.S.C. 1251 et seq., Public Law 92-50086 Stat. 816.

Field Blank: a blank matrix brought to the field and exposed to field environmental conditions.

Field of Proficiency Testing: NELAC's approach to offering proficiency testing by matrix, technology, and analyte/analyte group.

Good Laboratory Practices (GLP): formal regulations for performing basic laboratory operations outlined in 40 CFR Part 160 and 40 CFR Part 729 and required for activities performed under FIFRA and TSCA.

Holding Time: the maximum time that a sample may be held before preparation and/or analysis as promulgated by regulation or as specified in a test method.

Instrument Blank: a blank matrix that is the same as the processed sample matrix (i.e. extract, digestate, condensate) and introduced onto the instrument for analysis.

Internal Standard: A standard added to samples in known amount and carried through the procedure as a reference for calibration and controlling instrumental and analytical precision and bias.

Instrument Detection Limit (IDL): the minimum amount of a substance that can be measured with a specified degree of confidence that the amount is greater than zero using a specific instrument. The IDL is associated with the instrumental portion of a specific method only, and sample preparation steps are not considered in its derivation. The IDL is a statistical estimation at a specified confidence interval of the concentration at which the relative uncertainty is ±100%. The IDL represents a range where qualitative detection occurs on a specific instrument. Quantitative results are not produced in this range.

Laboratory Control Sample (LCS): a blank matrix spiked with a known amount of analyte(s), processed simultaneously with, and under the same conditions as, samples through all steps of the analytical procedure.

Laboratory Quality Manual (LQM): a document stating the quality policy, quality system and quality practices of the laboratory. The LQM may include by reference other documentation relating to the laboratory's quality system.

Limit of Detection (LOD): an estimate of the minimum amount of a substance that an analytical process can reliably detect. An LOD is analyte- and matrix-specific and may be laboratory-dependent.

Matrix: the substrate of a test sample. Common matrix descriptions are defined in Table 3.

Matrix Duplicate (MD): duplicate aliquot of a sample processed and analyzed independently; under the same laboratory conditions; also referred to as Sample Duplicate; Laboratory Duplicate.

Matrix Spike (MS): field sample to which a known amount of target analyte(s) is added.

Matrix Spike Duplicate (MSD): a replicate matrix spike.

Table 3. Matrix Descriptions

Matrix	Description
Air	Air samples as analyzed directly or as adsorbed into a solution or absorption matrix and desorbed.
Aqueous	Aqueous sample excluded from the definition of Drinking Water or Saline/Estuarine source. Includes surface water, groundwater and effluents.
Chemical Waste	A product or by-product of an industrial process that results in a matrix not previously defined.
Drinking Water	Aqueous sample that has been designated a potable water source.
Liquid	Liquid with <15% settleable solids.
Solid	Soil, sediment, sludge or other matrices with ≥15% settleable solids.
Waste	A product or by-product of an industrial process that results in a matrix not previously defined.

Method Blank (MB): a blank matrix processed simultaneously with, and under the same conditions as, samples through all steps of the analytical procedure.

Method Detection Limit (MDL): one way to establish a Limit of Detection, defined as the minimum concentration of a substance (an analyte) that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte.

Non-conformance: an indication, judgment, or state of not having met the requirements of the relevant specifications, contract, or regulation.

Precision: an estimate of variability. It is an estimate of agreement among individual measurements of the same physical or chemical property, under prescribed similar conditions.

Preservation: refrigeration and/or reagents added at the time of sample collection to maintain the chemical, physical and/or biological integrity of the sample.

Proficiency Testing: determination of the laboratory calibration or testing performance by means of inter-laboratory comparisons.

Proficiency Test (PT) Sample: a sample, the composition of which is unknown to the analyst, that is provided to test whether the analyst/laboratory can produce analytical results within specified performance limits. Also referred to as Performance Evaluation (PE) Sample.

Proprietary: belonging to a private person or company.

Quality Assurance (QA): an integrated system of activities involving planning, quality control, quality assessment, reporting and quality improvement to ensure that a product or service meets defined standards of quality with a stated level of confidence.

Quality Assurance Project Plan (QAPP): a formal document describing the detailed quality control procedures by which the quality requirements defined for the data and decisions pertaining to a specific project are to be achieved.

Quality Control (QC): the overall system of technical activities, the purpose of which is to measure and control the quality of a product or service.

Quality Control Sample: a sample used to assess the performance of all or a portion of the measurement system. QC samples may be Certified Reference Materials, a quality system matrix fortified by spiking, or actual samples fortified by spiking.

Quality Management Plan (QMP): a formal document describing the management policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an agency, organization or laboratory to ensure the quality of its product and the utility of the product to its users.

Quality System: a structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items), and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required QA/QC.

Quantitation Limit (QL): the minimum amount of a substance that can be quantitatively measured with a specified degree of confidence and within the accuracy and precision guidelines of a specific measurement system. The QL can be based on the MDL, and is generally calculated as 3-5 times the MDL, however, there are analytical techniques and methods where this relationship is not applicable. Also referred to as Practical Quantitation Level (PQL), Estimated Quantitation Level (EQL), Limit of Quantitation (LOQ).

Raw Data: any original information from a measurement activity or study recorded in laboratory notebooks, worksheets, records, memoranda, notes, or exact copies thereof and that are necessary for the reconstruction and evaluation of the report of the activity or study. Raw data may include photography, microfilm or microfiche copies, computer printouts, magnetic/optical media, including dictated observations, and recorded data from automated instruments. Reports specifying inclusion of “raw data” do not need all of the above included, but sufficient information to create the reported data.

Record Retention: the systematic collection, indexing and storing of documented information under secure conditions.

Reference Standard: a standard, generally of the highest metrological quality available at a given location, from which measurements made at that location are derived.

Reporting Limit (RL): The level to which data is reported for a specific test method and/or sample. The RL is generally related to the QL. The RL must be minimally at or above the MDL.

Resource Conservation and Recovery Act (RCRA): legislation under 42 USC 321 et seq. (1976).

Safe Drinking Water Act (SDWA): legislation under 42 USC 300f et seq. (1974), (Public Law 93-523).

Sampling and Analysis Plan (SAP): a formal document describing the detailed sampling and analysis procedures for a specific project.

Selectivity: the capability of a measurement system to respond to a target substance or constituent.

Sensitivity: the difference in the amount or concentration of a substance that corresponds to the smallest difference in a response in a measurement system using a certain probability level.

Spike: a known amount of an analyte added to a blank, sample or sub-sample.

Standard Operating Procedure (SOP): a written document which details the method of an operation, analysis or action whose techniques and procedures are thoroughly prescribed and which is accepted as the method for performing certain routine or repetitive tasks.

Storage Blank: a blank matrix stored with field samples of a similar matrix.

Systems Audit: a thorough, systematic, on-site, qualitative review of the facilities, equipment, personnel, training, procedures, record keeping, data validation, data management, and reporting aspects of a total measurement system.

Test Method: an adoption of a scientific technique for performing a specific measurement, as documented in a laboratory SOP or as published by a recognized authority.

Toxic Substances Control Act (TSCA): legislation under 15 USC 2601 et seq., (1976).

Traceability: the property of a result of a measurement that can be related to appropriate international or national standards through an unbroken chain of comparisons.

Trip Blank: a blank matrix placed in a sealed container at the laboratory that is shipped, held unopened in the field, and returned to the laboratory in the shipping container with the field samples.

Verification: confirmation by examination and provision of evidence against specified requirements.

3.1 Formulas and Calculations

The laboratories use a number of calculations in the analytical process. Following are the most common calculations and formulas. Additional calculations/formulas are included in the respective analytical SOPs.

Mean ($\bar{x}$): Adding together the numerical values (a, b, c, etc.) of an analysis and dividing this sum by the number *n* of measurements used yields the mean.

$$\bar{x} = \frac{a + b + c}{n}$$

Standard Deviation (s): The standard deviation is calculated by taking the square root of the quotient from the sum of all the squared individual deviations divided by one less than the number of measurements ($n - 1$) used in the analysis. Statistically it has been determined that as the number of measurements *n* exceeds 30, the $n - 1$ term can be simplified to *n*.

$$s = \sqrt{\frac{x^2 + y^2 + z^2 \ldots}{n - 1}}$$

The standard deviation can be calculated in five steps:

1. Determine the mean ($\bar{x}$).
2. Subtract the mean from each measured data item.
3. Square each difference.
4. Find the average of the squared terms in step 3.
5. Calculate the square root of the average found in step 4 by dividing by one less than the actual number of measurements.

Relative Percent Difference (RPD): The difference between two values divided by the average of the values as expressed as a percent.

$$RPD = \left| \frac{A - B}{(A + B)/2} \right| x\,100$$

A = Measured concentration of the first sample or spike aliquot
B = Measured concentration of the second sample or spike aliquot

Percent Recovery (% Recovery): A means for expressing the accuracy of a test. Percent recovery expresses what proportion of a known quantity can be measured by a given analytical technique. This QA/QC measurement is applicable to standards, spiked blanks, and spiked samples. It is calculated by dividing the result of the analysis (less any blank or sample contribution) by the known quantity of the analyte, expressed as a percentage. An example of the calculation is shown below.

$$\%\ \mathrm{Recovery} = \frac{SSR - SR}{SA}\ x\ 100$$

SSR = Spike sample result
SR = Sample result
SA = Spike added from spiking standard

Response Factor: Expresses the sensitivity of the detector relative to a standard substance. The following shows how to calculate a response factor for each analyte of interest and surrogate using the internal standard method.

$$RF = \frac{(Ax)(Cis)}{(Ais)(Cx)}$$

Ax = Integrated abundance of quantitation ion of the analyte
Ais = Integrated abundance of quantitation ion of internal standard
Cx = Concentration of analyte purged
Cis = Concentration if internal standard purged

Relative Response Factor (RRF): The relative response factors for each target compound are calculated relative to the appropriate internal standard (i.e. standard with the nearest retention time).

$$RRF = \frac{AxCis}{AisCx}$$

RRF = Relative Response Factor
Ax = Area of the primary ion for the compound to be measured, counts
Ais = Area of the primary ion for the internal standard, counts
Cis = Concentration of internal standard spiking mixture, ppbv
Cx = Concentration of the compound in the calibration standard, ppbv

[Note: The equation above is valid under the condition that the volume of internal standard spiking mixture added in all field and QC analyses is the same from run to run, and that the volume of field and QC sample introduced into the trap is the same for each analysis. Cis and Cx must be in the same units].

Result calculation: The area of the sample is read from the quantitation report to give the result of the compound (in the examples the reporting units are in micrograms). The result is obtained as follows:

Waters:

$$\mu g / L = \frac{\mu g *}{L}\ x\ \frac{Vf}{Vi}\ x\ dilution\ \ factor$$

Solids/Diluted Wastes:

$$mg / Kg = \frac{\mu g *}{mL}\ x\ \frac{Vf}{W}\ x\ dilution\ \ factor$$

Vf = Final Volume (mL)
Vi = Initial Sample Volume (L)
W = Weight (g)

* Read from quantitation report

4.0 Management Requirements

The organizational chart of TestAmerica-STL is presented in Figure 1. Corporate employees are located at various TestAmerica-STL facilities as outlined in the organizational structure. The organizational chart of AEL is presented in Figure 2.

4.1 Organization and Management

The Laboratory Director and Quality Assurance Manager are responsible and have the signature authority for approving and implementing this plan. Additional signatory authorities for the approval of work and release of reports are defined in the Arizona Department of Health Services, Environmental Laboratory Licensure Application – Part B – Laboratory Personnel, the National Environmental Laboratory Accreditation Conference Standards, and the American Industrial Hygiene Association Policies.

Figure 1. TestAmerica-STL Organization Chart

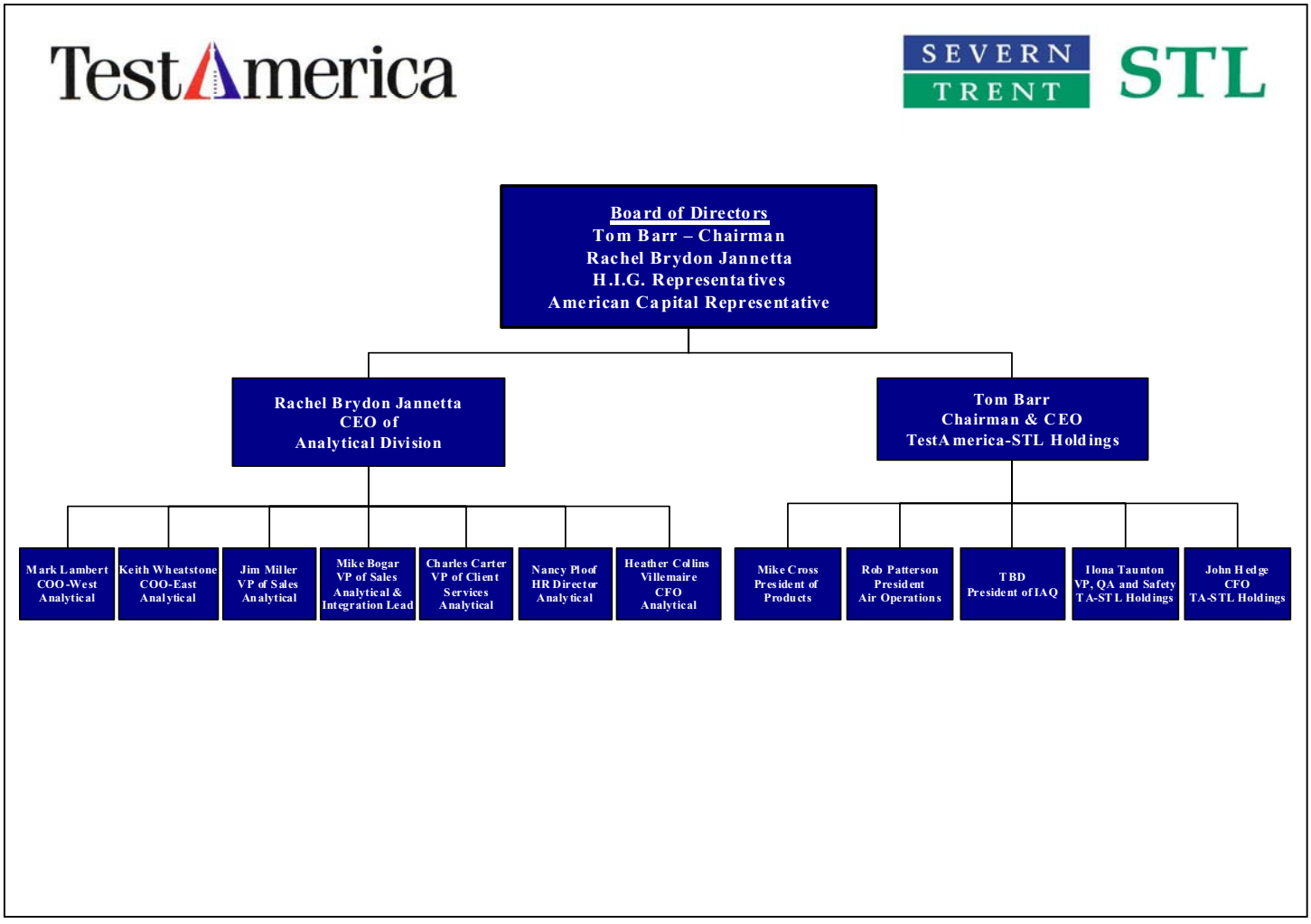
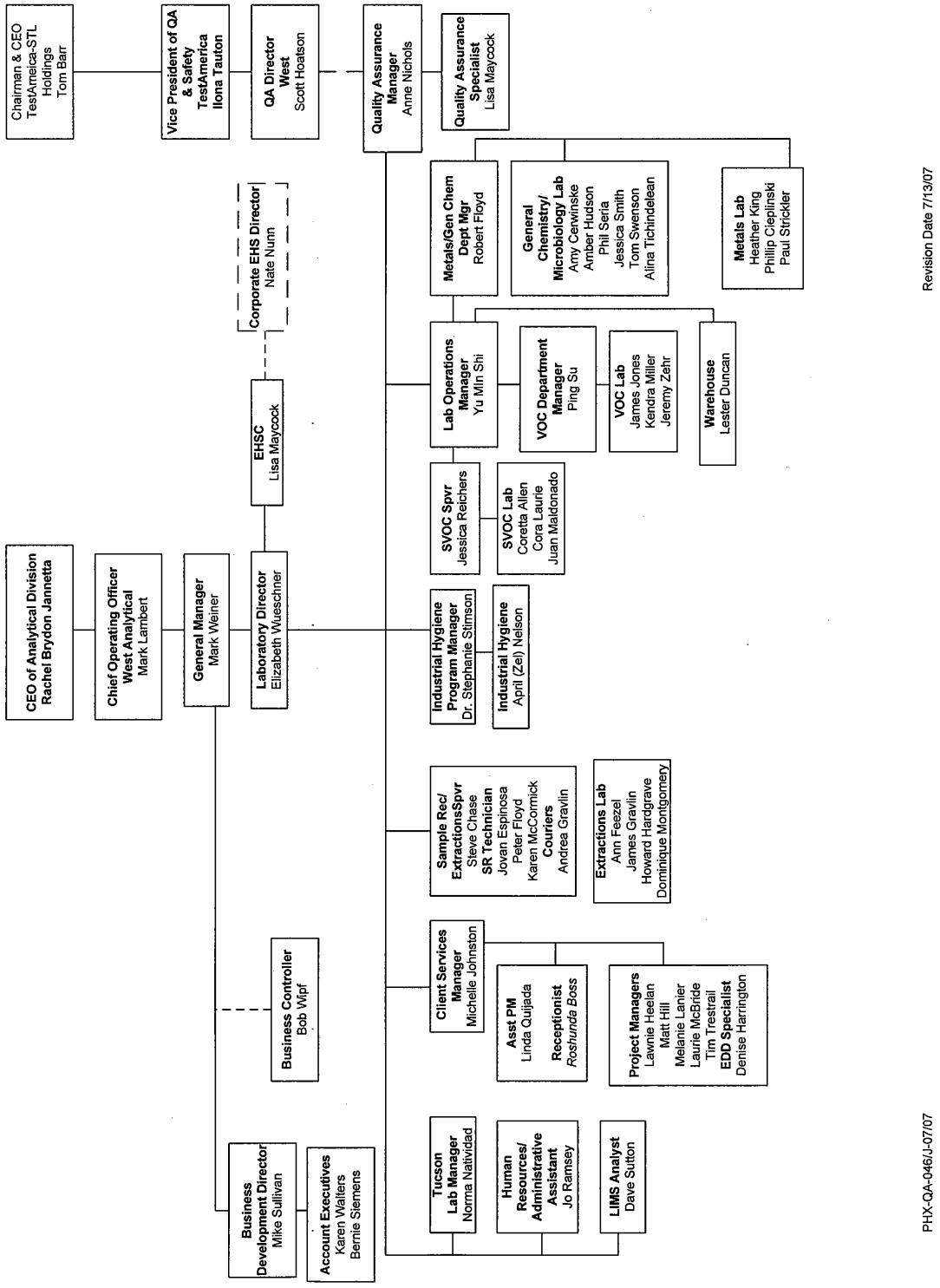


Figure 2. AEL Organization Chart



4.1.1 Laboratory Facilities

Aerotech Environmental Laboratories is an environmental laboratory with facilities in Phoenix Arizona and Tucson Arizona. The facilities are dedicated to the production of high quality, cost effective analytical services.

The Phoenix facility is located at 4645 East Cotton Center Boulevard, Building 3, Suite 189. It is a 24,000 square foot, state-of-the-art commercial laboratory, with individual laboratories for air, microbiology, semi-volatile organics, volatile organics, and inorganic operations. The facility is divided into separate work areas to facilitate sample throughput.

The laboratory is equipped with state-of-the-art instrumentation and sufficient duplicate equipment to provide back-up service for most major systems. A listing of laboratory equipment and instrumentation is referenced as AEL Master Equipment List (PHX-QA-049). Table 4 is a summary of the major laboratory instruments.

Table 4. Major Equipment List

GC	GC/MS	ICP	ICP/MS	CVAA	HPLC	Auto Analyzer	IC
9	8	2	1	1	3	2	3

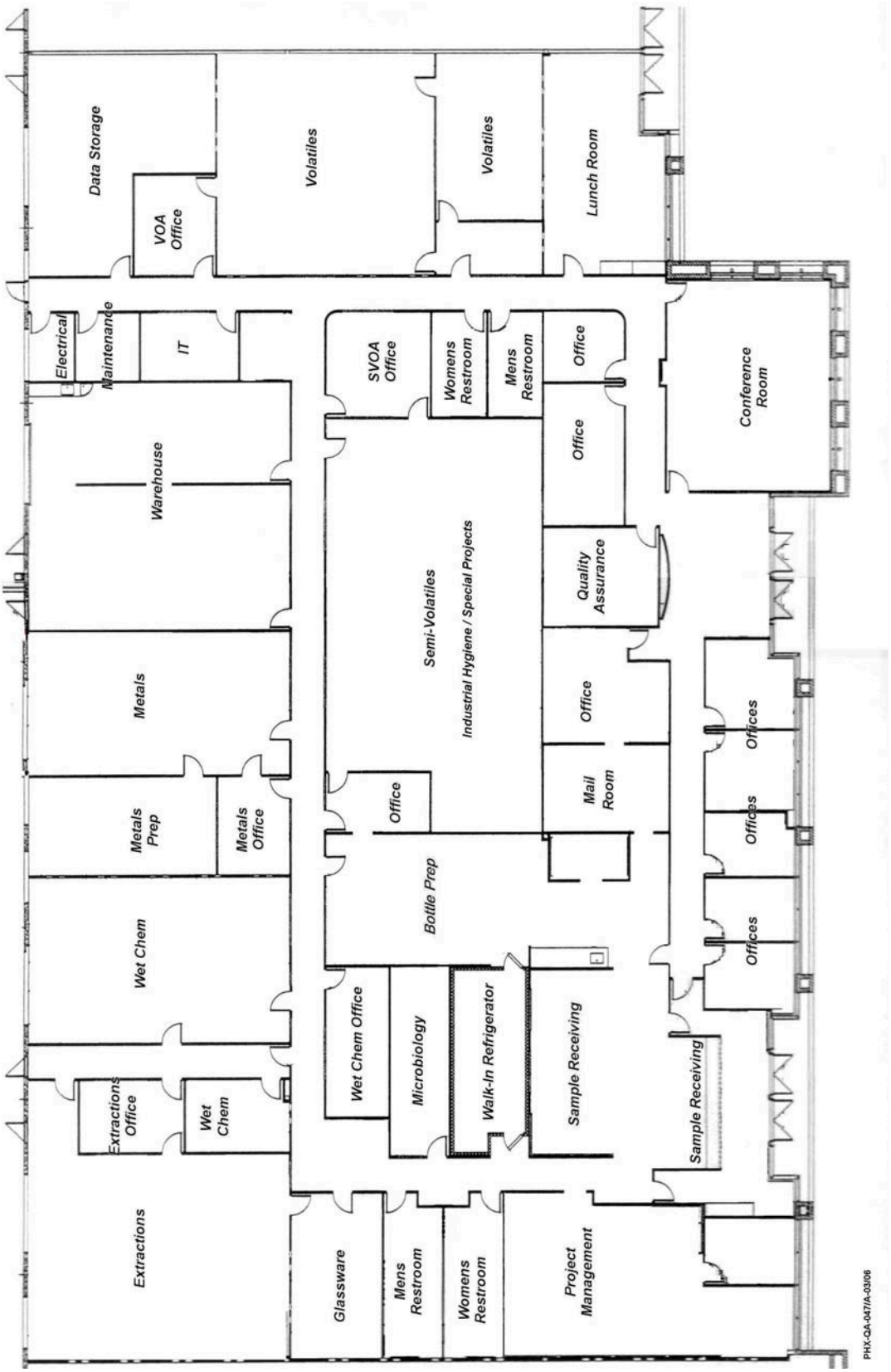
We encourage clients to tour the laboratory to see the dedication to quality and the systems that are in place to handle clients' needs. A tour can be scheduled by calling the Laboratory Director.

Each of these areas has separate heating, ventilation, and air conditioning systems. Non-destructive gas chromatographic detectors, and GC/MS rotary pumps are vented out of the instrumentation through charcoal filters.

The Tucson service center is located at 4455 South Park Avenue, Suite 110. It is a 1,761 square facility.

A floor plan of the Phoenix laboratory is shown in Figure 3.

Figure 3. Phoenix Floor Plan



4.1.2 Roles and Responsibilities

The specific duties and responsibilities of the Laboratory Director, Operations Manager, Quality Assurance Manager, Department Supervisors, Client Services Manager, Project Managers, Sample Receiving Supervisor, Quality Assurance Specialist, Environmental Health and Safety Coordinator, LIMS Analyst, and Chemists/Technicians are as follows:

In the absence of any one individual, the staff or assistant within each department is professionally skilled in the ability to administer the function of the administrator or support personnel. This will allow for the continuance of the day-to-day operations of the laboratory.

4.1.2.1 Laboratory Director

- Reports directly to the Regional General Manager.
- Responsible for implementation and adherence by lab staff to the corporate policies, AEL LQM, and all policies and procedures within the laboratory.
- Has signature authority for LQM, policies, SOPs, and contracts (as detailed in corporate policy).
- Annually assesses the effectiveness of the quality system within the lab.
- Maintains adequate trained staffing.
- Responsible for implementing corrective actions for internal and external audits.

4.1.2.2 Operations Manager

- Responsible for coordinating the development and implementation of methods and SOPs.
- Performs technical training in area(s) of expertise.
- Interfaces with management on technical needs and solving day-to-day technical issues.
- Determines qualifications required for technical positions and evaluates job candidates against those requirements.
- Investigates technical issues related to projects as directed by the Laboratory Director and Quality Assurance.
- Certifies technical laboratory personnel based on education and background to ensure that staff have demonstrated capability in the activities for which they are responsible.
- Performs other tasks as required by NELAC.

4.1.2.3 Quality Assurance Manager

- Reports directly to the Laboratory Director and, for all QA matters, to the Corporate QA Director to maintain independence of QA oversight.
- Serves as the focal point for QA/QC and is responsible for the oversight and/or review of quality control data.
- Responsible for implementing corrective actions for internal and external audits.
- Maintains, approves, communicates and implements the LQM.
- Has joint signature authority, with the Laboratory Director for approval of quality documents, e.g., LQM, policies, and SOPs.
- Directs controlled distribution of laboratory quality documents.
- Provides QA training to all new personnel.
- Reviews and approves documentation of analyst training records.
- Reviews corrective actions and recommends resolution for recurring nonconformances within the laboratory.
- Assists in maintaining regulatory analytical compliance, including maintaining certifications.
- Monitors data quality indicators using statistical methods to verify that the laboratory routinely meets stated quality goals.
- Performs systems, data, contract compliance, and surveillance audits.
- Hosts external audits conducted by outside agencies.

- Approves quality control reference data changes in the LIMS.
- Oversees the selection, review, and approval of analytical subcontractors.
- Prepares monthly QA Reports to management describing significant quality events.

4.1.2.4 Client Services Manager

- Reports directly to the Laboratory Director.
- Supervises daily activities of the Project Management group.
- Works with the Operations Manager, and the Department Supervisors to ensure the requirements of projects are met in a timely manner.
- Has signature authority for laboratory reports.
- Defines customer requirements through project definition.
- Assesses and assures customer satisfaction.
- Provides feedback to management on changing customer needs.
- Brings together resources necessary to ensure customer satisfaction.

4.1.2.5 Department Supervisor

- Supervises daily activities of their operational group.
- Schedules analytical operations.
- Supervises QC activities performed as a part of routine analytical operations.
- Implements data review procedures.
- Supervises the preparation and maintenance of laboratory records.
- Supervises maintenance of instruments and scheduling of repairs.
- Works with the Project Managers to ensure that the requirements of projects are met in a timely manner.
- Responsible for meeting quality requirements.
- Responsible for implementing corrective actions for internal and external audits.

4.1.2.6 Project Managers

- Reports directly to the Client Services Manager.
- Monitors analytical and QA project requirements for a specified project.
- Acts as a liaison between the client and the laboratory staff.
- Communicates project-specific requirements to all parties involved.
- Assists the laboratory staff with interpretation of work plans, contracts, and QAPP requirements.
- Reviews project data packages for completeness and compliance to client needs.
- Has signature authority for final reports.
- Keeps the laboratory and client informed of project status.
- Monitors, reviews, and evaluates the progress and performance of projects.
- Reports client inquiries involving data quality issues or data acceptability to the facility QA Manager and to the operations staff.
- Prepares reissue requests for project data.
- Responsible for meeting quality requirements.

4.1.2.7 Sample Receiving Manager

- Ensures implementation of proper sample receipt procedures, including maintenance of chain-of-custody.
- Reports nonconformances associated with condition-upon-receipt of samples.
- Logs samples into the LIMS.
- Ensures that all samples are stored in the proper environment.
- Responsible for meeting quality requirements.

4.1.2.8 Quality Assurance Specialist

- Responsible for preparation, compilation, submittal and review of Quality Assurance Project Plans.
- Performs annual internal audits.
- Assists in responding to external audits.
- Arranges and manages the performance testing (PT) studies.
- Reviews personnel training records, MDLs, DOCs, QA documents and laboratory records.
- Maintains all necessary laboratory certifications.
- Ensures the maintenance of records archiving.
- Assists in monitoring method compliance, including reviewing and writing SOPs.

4.1.2.9 Environmental Health and Safety Coordinator

- Responsible with the Laboratory Director for the safety and well being of all employees while at the laboratory.
- Responsible for implementing and communicating the Corporate Safety Manual.
- Addresses laboratory compliance issues related to the Corporate Safety Manual.
- Provides MSDS training and review.
- Conducts laboratory safety orientation and tours for all new employees.
- Acts as Chairperson of the Safety Committee.
- Ensures quarterly safety inspections are performed, documented and corrective actions are implemented.
- Hosts annual internal audits conducted by EHSD.
- Provides instructions on safety equipment, cleaning up laboratory spills, and instructing personnel of laboratory procedures for emergency situations.
- Manages the laboratory-generated hazardous waste in accordance with appropriate regulations.
- On-call 24-hours a day, 7-days a week for all laboratory situations.

4.1.2.10 LIMS Analyst

- Responsible for providing data security by controlling access, and for providing for disaster recovery for electronic data.
- Oversees data storage on the Laboratory Information Management System (LIMS).
- Provides procedures and training to all laboratory operations, as appropriate, to assist in making backup copies of local data.

STL has established procedures for IT management:

- *Computer Systems Account and Naming Policy* – P-I-003
- *Computer Systems Password Policy* – P-I-004
- *Software Licensing Policy* – P-I-005
- *Virus Protection Policy* – P-I-006

4.1.2.11 Chemists / Technicians

- Performs analytical methods and data recording in accordance with documented procedures.
- Performs and documents calibration and preventive maintenance.
- Performs data processing and data review procedures.
- Reports nonconformances to the Department Supervisor and QA Manager.
- Responsible for meeting quality requirements defined in this LQM and other supporting QA procedures.

4.2 Quality System

The quality system and quality objectives are driven by this LQM, SOPs and Work Instructions. Within these documents, the Laboratory Director and QA Manager ensure that the quality policy is understood, implemented, and

maintained at all levels of the organization. The development and implementation of appropriate accountabilities, duties, and authority by organizational positions are clearly delineated. Line organizations achieve and verify that specifications are achieved; the QAM provides oversight and verification of processes through planning, reviews, audits, and surveillances. The Laboratory Director's leadership, support and direction ensure that the policies and procedures are implemented throughout the organization.

4.2.1 Objectives of the Quality System

The goal of the quality system is to ensure that business operations are conducted with the highest standards of professionalism and data integrity in the industry.

To achieve this goal, it is necessary to provide our clients with scientifically sound, well documented, regulatory compliant data, and to ensure that we provide the highest quality service available in the industry with uncompromising data integrity. A well-structured, organized and communicated quality system is essential in meeting this goal. The laboratory's quality system is designed to minimize systematic error, encourage constructive, documented problem solving, and provides a framework for continuous improvement.

This LQM, Work Instructions and the SOPs are the basis and outline for our quality and data integrity system and contain requirements and general guidelines under which the laboratory conducts operations. In addition, other documents may be used by the laboratory to clarify compliance with quality system or other client requirements. Within the LQM, SOP or Work Instruction, identifying numbers are noted. These numbers refer to the laboratory procedure(s) associated with the subject item. A table listing these quality system policies and procedures is appended to this document.

The QA Manager is responsible for implementing and monitoring the Quality System. The QA Manager reports to the Laboratory Director on the performance of the quality system for review and continuous improvement. The QA Manager has sufficient authority, access to work areas, and organizational freedom (including sufficient independence from cost and schedule considerations) to:

- Initiate action to prevent the occurrence of any nonconformities related to product, process and quality system,
- Identify and record any problems affecting the product, process and quality system,
- Initiate, recommend, or provide solutions to problems through designated channels,
- Verify implementation of solutions, and
- Assure that further work is stopped or controlled until proper resolution of a non-conformance, deficiency, or unsatisfactory condition has occurred and the deficiency or unsatisfactory condition has been corrected.

The QA Manager identifies opportunities for continual improvement. When a situation arises where acceptable resolution of identified issues cannot be agreed upon at the laboratory, direct access to TestAmerica-STL's Corporate Quality Director is available. This provides laboratory QA personnel independence, where needed, to ensure that QA policies and procedures are enforced.

The QA Manager conducts annual LQM training for all laboratory and administrative personnel to ensure their familiarity with the quality documentation and the implementation of the policies and procedures in their work.

4.3 Document Control

The laboratory maintains procedures to control documents and analytical data. Since an extensive quantity of data is generated and this is our primary product, document control is inherently segregated from data control, as described further in Sections 4.3.1 and 4.3.2.

4.3.1 Document Control Procedure

Organization, security and control of documents are necessary to ensure that confidential information is not distributed and that all current copies of a given document are from the latest applicable revision (AQUA database and Controlled Documents Matrix; PHX-QA-001).

Controlled documents are authorized and records of their distribution and archiving are maintained by the QA Department. For tracking purposes, a control copy number is assigned to documents distributed with a controlled status (SOPs and LQMs).

4.3.1.1 Document Revision

Changes to documents occur when a procedural change warrants a revision of the document. After document revisions are authorized, all outdated versions are removed from use and disposed or segregated from the active/current document versions. A single copy of the archived document is retained for historical purposes. This archived version is clearly identified as "Obsolete".

SOPs are updated on a 12-24 month basis, which is tracked by an established review schedule (AQUA database and SOP Expiration Date Tracking spreadsheet (PHX-QA-051)). These reviews are conducted by the writer/reviewer, the QA Manager, the department supervisor, the Laboratory Director and the Health and Safety Coordinator. The reviewer/Department Supervisor, the QA Manager and the Laboratory Director approve and sign each SOP.

4.3.2 Data Control

All raw data, such as bound logbooks, instrument printouts, magnetic tapes, electronic data, as well as final reports, are retained for a minimum period of 5 years, unless otherwise specified by client or regulatory requirements. Such data may be maintained longer, as defined by client and project requirements. Specifics on the procedure of archiving records are contained in the Archiving Computer Records SOP (09-017).

Raw data and reports are documented and stored in a manner that is easily retrievable. The procedure for maintaining raw data records is briefly described below:

- Instrument print-outs for conventional inorganic parameters are filed by parameter and month. Inorganic, Metals and Organic data are filed by Instrument and Filename.
- All raw data, for example, instrument print-outs and logbooks, are maintained in a secured storage area or records are scanned and retained on electronic media.
- The computer information is backed up on tape daily, and stored in a secured and temperature/humidity controlled environment to maintain the integrity of the electronic information in the event of system failure. Copies of all back-up tapes are maintained in secured off-site locations.
- All copies of client final reports are maintained in hard copy format or electronically (e.g., Adobe Acrobat).

4.4 Request, Tender, and Contract Review

4.4.1 Contract Review

For many environmental sampling and analysis programs, testing design is site or program specific and does not necessarily "fit" into a standard laboratory service or product. It is AEL's intent to provide both standard and customized environmental laboratory services to our clients. To ensure project success, technical staff perform a

thorough review of technical and QC requirements contained in contracts. Contracts are reviewed for adequately defined requirements and AEL's capability to meet those requirements.

All contracts entered into by the laboratory are reviewed for the client's requirements in terms of compound lists, test methodology requested, sensitivity, accuracy, and precision requirements. The reviewer ensures that the laboratory's test methods are suitable to achieve these regulatory and client requirements and that the laboratory holds the appropriate certifications and approvals to perform the work. The review also includes the laboratory's capabilities in terms of turnaround time, capacity, and resources to provide the services requested, as well as the ability to provide the documentation, whether hardcopy or electronic. If the laboratory cannot provide all services but intends to subcontract such services, whether to another TestAmerica-STL facility or to an outside firm, this will be documented and discussed with the client prior to contract approval.

Any contract requirement or amendment to a contract communicated to AEL verbally is documented and confirmed with the client in writing (e.g., letter, contract, e-mail, etc.). Any discrepancy between the client's requirements and AEL's capability to meet those requirements is resolved in writing before acceptance of the contract. Contract amendments, initiated by the client and/or AEL, are documented in writing for the benefit of both the client and AEL. All contracts, QAPPs, Sampling and Analysis Plans (SAPs), contract amendments, and documented communications become part of the permanent project record.

4.4.2 Project-Specific Quality Planning

Communication of contract specific technical and QC criteria is an essential activity in ensuring the success of site-specific testing programs. To achieve this goal, AEL assigns a Project Manager (PM) to each client. The PM is the first point of contact for the client. It is the PM's responsibility to ensure that project specific technical and QC requirements are effectively evaluated and communicated to the laboratory personnel before and during the project. QA department involvement may be needed to assist in the evaluation of custom QC requirements.

PM's are the direct client contact and they ensure resources are available to meet project requirements. Although PM's do not have direct reports or staff in production, they coordinate opportunities and work with laboratory management and supervisory staff to ensure available resources are sufficient to perform work for the client's project. Project management is positioned between the client and laboratory resources.

Prior to work on a new project, the dissemination of project information and/or project opening meetings may occur to discuss schedules and unique aspects of the project. Items to be discussed may include the project technical profile, turnaround times, holding times, methods, analyte lists, reporting limits, deliverables, sample hazards, or other special requirements. The PM introduces new projects to the supervisory staff during production meetings. These meetings provide direction to the laboratory staff in order to maximize production and client satisfaction, while maintaining quality. In addition, project notes may be associated with each sample batch as a reminder upon sample receipt and analytical processing.

Any change that may occur within an active project is agreed upon between the client/regulatory agency and the Project Manager/laboratory. These changes (e.g., use of a non-standard method or modification of a method) must be documented prior to implementation. Documentation pertains to any document, e.g., letter, variance, contract addendum, which has been signed by both parties.

Such changes are also communicated to the laboratory through the management production meetings, which are conducted weekly. Such changes are updated to the project notes and are introduced to the managers at these meetings. The laboratory staff is then introduced to the modified requirements via the Project Manager or the individual laboratory Department Supervisor. After the modification is implemented into the laboratory procedure, documentation of the modification is made in the case narrative of the data report(s).

AEL strongly encourages client visits to the laboratory and for formal/informal information sharing session with employees in order to effectively communicate ongoing client needs as well as project specific details for customized testing programs.

4.4.3 Data Quality Objectives

Data quality objectives (DQO) are qualitative and quantitative statements used to ensure the generation of the type, quantity, and quality of environmental data that will be appropriate for the intended application. Typically, DQOs are identified before project initiation and during the development of a QAPPs and SAPs. The analytical DQOs addressed in this section are precision, accuracy, representativeness, completeness, and comparability.

The components of analytical variability (uncertainty) can be estimated when QC samples of the right types and at the appropriate frequency are incorporated into the measurement process of the laboratory. AEL incorporates numerous QC samples to obtain data for comparison with the analytical DQOs and to ensure that the measurement system is functioning properly. The control samples and their applications, described in Section 5.8.2, are selected based on analytical method or client-specific requirements. Analytical QC samples for inorganic and organic analyses may include calibration blanks, instrument blanks, method blanks, laboratory control standards, calibration standards, matrix spikes, matrix duplicates, and surrogate spikes.

The DQOs discussed below ensure that data are gathered and presented in accordance with procedures appropriate for its intended use, that the data is of known and documented quality, and are able to withstand scientific and legal scrutiny.

4.4.3.1 Precision

Precision is an estimate of variability. It is an estimate of agreement among individual measurements of the same physical or chemical property, under prescribed similar conditions. Precision is expressed either as Relative Standard Deviation (RSD) for greater than two measurements or as Relative Percent Difference (RPD) for two measurements. Precision is determined, in part, by analyzing data from LCSs, MS, MSD, and MD.

Precision also refers to the measurement of the variability associated with the entire process, from sampling to analysis. Total precision of the process can be determined by analysis of duplicate or replicate field samples and measures variability introduced by both the laboratory and field operations.

4.4.3.2 Accuracy

Accuracy is the degree of agreement between a measurement and the true or expected value, or between the average of a number of measurements and the true or expected value. It reflects the total error associated with a measurement.

Both random and systematic errors can affect accuracy. For chemical properties, accuracy is expressed either as a percent recovery (R) or as a percent bias (R - 100). Accuracy is determined, in part, by analyzing data from LCSs, MS and MSD.

Accuracy and Precision objectives employed by the laboratory are as defined in the CERCLA's Inorganic and Organic Statements of Work (SOW); statistically-derived control limits; or default limits as listed in each respective method SOP.

4.4.3.3 Representativeness

Representativeness is the degree to which data accurately and precisely represent a characteristic of a population, a variation in a physical or chemical property at a sampling point, or an environmental condition. Data representativeness is primarily a function of sampling strategy; therefore, the sampling scheme must be designed to maximize representativeness. Representativeness also relates to ensuring that, through sample homogeneity, the sample analysis result is representative of the constituent concentration in the sample matrix. AEL makes every effort to analyze an aliquot that is representative of the original sample, and to ensure the homogeneity of the sample before sub-sampling.

4.4.3.4 Completeness

Completeness is defined as the percentage of measurements that are judged valid or useable. Factors negatively affecting completeness include the following: sample leakage or breakage in transit or during handling, loss of sample during laboratory analysis through accident or improper handling, improper documentation such that traceability is compromised, or sample result is rejected due to failure to conform to QC specifications. A completeness objective of greater than 90% of the data specified by the statement of work is the goal established for most projects.

4.4.3.5 Comparability

Comparability is a measure of the confidence with which one data set can be compared to another. To ensure comparability, all laboratory analysts are required to use uniform procedures (e.g., SOPs) and a uniform set of units and calculations for analyzing and reporting environmental data.

A measure of inter-laboratory comparability is obtained through the laboratory's participation in proficiency testing (PT) programs established with Water Supply (WS), Water Pollution (WP), Solid Waste (SW), Underground Storage Tank (UST) and American Industrial Hygiene Association (AIHA) programs. In addition, the laboratory employs the use of NIST or EPA traceable standards, when available, to provide an additional measure of assurance of the comparability of data.

Project representativeness and comparability are dependent upon the sampling plan on a project specific basis, and are therefore not covered in this LQM. Assessment of site and collection representativeness and comparability is performed by client or field engineer.

4.4.3.6 Additional DQOs

Method Detection Limits

The method detection limit (MDL) is the lowest concentration that can be detected for a given analytical method and sample matrix with 99% confidence that the analyte is present. The MDL is determined according to Appendix B of 40 CFR 136, "Guidelines Establishing Test Procedures for the Analysis of Pollutants". MDLs reflect a calculated (statistical) value determined under ideal laboratory conditions in a clean matrix, and may not be achievable in all environmental matrices. The laboratory maintains MDL studies for analyses performed; these are verified at the frequency listed in the analytical SOP. MDLs are performed at least annually for drinking water methods.

For the performance of non-routine methods, e.g., client/contract requirement, MDLs or Method Validation Studies will be completed on an as needed basis. The turnaround time for such studies will be as determined by the client, the Project Manager, and the Department Supervisor/Laboratory Director. Such studies will be reviewed and approved by the client and/or regulatory agency prior to project implementation.

Instrument Detection Limits

There are a number of ways to determine Instrument Detection Limit (IDL) sensitivity (e.g., signal-to- noise ratio, precision of the low-level standard, lowest calibration curve point or the IDL study defined within CLP). The method and means in which IDLs are determined are documented and maintained in the QA department for each individual instrument.

IDLs are generated for each element by the metals laboratory periodically based on project or program requirements. These limits are used to gauge instrument sensitivity without the introduction of preparation method variance.

Reporting Limits

Reporting Limits are defined as the lowest concentration of an analyte determined by a given method in a given matrix that the laboratory feels can be reported with acceptable quantitative error or client requirements, values specified by the EPA methods or other project and client requirements. The laboratory reporting limits are further related and verified by the lowest point on a calibration curve. Because of the high level of quantitative error associated with determinations at the level of the MDL, the laboratory endeavors to keep reporting limits higher than the MDL. Wherever possible, reporting is limited to values approximately 3-5 times the respective MDL to ensure confidence in the value reported. Client specific requests for reporting to the IDL or MDL are special circumstances not to be confused with the previous statement. Data evaluated down to the MDL/IDL is qualified as estimated with an "E" on the data report.

MDL studies are performed at the frequency specified in the analytical SOP, and reporting limits are assessed. If the MDL does not meet the routine laboratory reporting limit, or the method specified limit, it is repeated or the laboratory reporting limit is reassessed. If the laboratory continually demonstrates that the method reporting limits are not achieved, equipment, technique, and the method are reviewed to assure optimal performance or appropriate action is taken.

4.5 Subcontracting

Subcontracting is arranged with the documented consent of the client, in a timely response, which shall not be unreasonably refused. All QC guidelines specific to the client's analytical program are transmitted to the subcontractor and agreed upon before sending the samples to the subcontract facility. Proof of required certifications from the subcontract facility are maintained in the project records. Where applicable, specific QC guidelines, QAPPs, and/or SAPs are transmitted to the subcontract laboratory (Subcontracting Procedures; S-L-001). Samples are subcontracted under formal Chain of Custody (COC).

Subcontract laboratories may receive an on-site audit by a representative of AEL's QA staff if it is deemed appropriate by the QA Manager. The audit involves a measure of compliance with the required test method, QC requirements, as well as any special client requirements. AEL may also perform a paper audit of the subcontractor, which would entail reviewing the LQM, the last two PT studies, and a copy of any recent regulatory audits with the laboratory's responses.

Intra-company subcontracting may also occur between TestAmerica-STL facilities. Intra-company subcontracting within TestAmerica-STL is arranged with the documented consent of the client or a QAPP specification. The originating laboratory is responsible for communicating all technical, quality, and deliverable requirements as well as other contract needs.

Project reports from both TestAmerica-STL and external subcontractors are not altered and are included in their original form in the final project report provided by AEL. This clearly identifies the data as being produced by a subcontractor facility. If subcontract data is incorporated into the laboratories report (i.e., imported), the report must explicitly indicate which lab produced the data for which methods and samples, as required in Section 5.9.4.

4.6 Purchasing Services and Supplies

Evaluation and selection of suppliers and vendors is performed, in part, on the basis of the quality of their products, their ability to meet the demand for their products on a continuous and short term basis, the overall quality of their services, their past history, and competitive pricing. This is achieved through evaluation of objective evidence of quality furnished by the supplier, which can include certificates of analysis, recommendations, and proof of historical compliance with similar programs for other clients. To ensure that quality critical consumables and equipment conform to specific requirements, all purchases from specific vendors are approved by a member of the supervisory or management staff.

Chemical reagents, solvents, glassware, and general supplies are ordered as needed to maintain sufficient quantities on hand. Purchasing guidelines for equipment and reagents meet with the requirements of the specific method and testing procedures for which they are being purchased. The measurements for evaluation and selection of suppliers; the acceptance of supplies and services; and certificates of conformance are described in the Purchase Order Requirements Policy (P-Pu-001) and AEL Purchasing Procedure SOP (09-038).

4.6.1 Solvent and Acid Lot Verification

Pre-purchase approval is performed for solvents and acids purchased in large quantities unless a certificate of conformance has been furnished. These may include acetone, ethyl ether, hexane, methylene chloride, nitric acid, hydrochloric acid, sulfuric acid, and hydrogen peroxide. Each lot of incoming supplies requiring pre-approval is checked against the previously approved lot number. If the lot number is not approved, the lot is refused. If the lot number is an approved lot number, it is accepted and documented. Solvents and acids are pre-tested in accordance with STLs Corporate *Testing Solvents and Acids* procedure (S-T-001) for all of the STL laboratories.

4.7 Service to the Client

4.7.1 Client Communications

Working with clients and their needs is the central focus of the company. This is achieved through clear, and timely communications using the telephone, e-mail, in writing or by other means.

Samples are considered “compromised” and the client notified if the following conditions are observed upon sample receipt:

- Cooler and/or samples are received outside of temperature specification.
- Samples are received broken or leaking.
- Samples are received beyond holding time.
- Samples are received without appropriate preservative.
- Samples are received in inappropriate containers.
- COC does not match samples received.
- COC is not properly completed or not received.
- Breakage of any Custody Seal.
- Apparent tampering with cooler and/or samples.
- Headspace in volatile samples.
- Seepage of extraneous water or materials into samples.
- Inadequate sample volume.
- Illegible, impermanent, or non-unique sample labeling.

When "compromised" samples are received, it is documented on the hardcopy COC or on the Sample Receipt Checklist; and the client is contacted for instructions. If the client decides to proceed with the analysis, the project report will clearly indicate any of the above conditions and the resolution.

4.7.2 Client Confidentiality and Proprietary Rights

Data and sample materials provided by the client or at the client's request, and the results obtained by AEL, shall be held in confidence (unless such information is generally available to the public or is in the public domain or client has failed to pay AEL for all services rendered or is otherwise in breach of the terms and conditions set forth in the AEL and client contract) subject to any disclosure required by law or legal process. Technical, business and proprietary information provided by a client and data/information generated by the laboratory are restricted for the use within the laboratory for purposes of accomplishing the project. Client information is not to be used on other projects or revealed except in conjunction with project work to anyone outside the laboratory without permission of the client.

AEL's reports, and the data and information provided therein, are for the exclusive use and benefit of client, and are not released to a third party without written consent from the client (Confidentiality and Proprietary Information Agreement (refer to TestAmerica-STL Ethics Policy, CA-L-001)).

4.8 Complaints

AEL believes that effective client complaint handling processes have important business and strategic value. Listening to and documenting client's concerns captures 'client knowledge' that helps to continually improve processes and outpace the competition. Implementing a client complaint handling process also provides assurance to the data user that the laboratory will stand behind its data, service obligations and products.

Client inquiries, complaints or noted discrepancies are documented, communicated to management, and addressed promptly and thoroughly. The investigation of the cause, resolution and authorization of corrective action is documented (Internal Root Cause Investigation (09-037)).

Client complaints are documented by the employee receiving the complaint. The documentation can take the form of a resubmitted data request or in a format specifically designed for that purpose (e.g., phone conversation record or e-mail). The Laboratory Director, Client Services Manager, Operations Manager and/or QA Manager are informed of client complaints and assist in resolving the complaint.

The nature of the complaint is identified, documented and investigated, and an appropriate action is determined and taken. In cases where a client complaint indicates that an established policy or procedure was not followed, the QA department is required to conduct a special audit to assist in resolving the issue. A written confirmation, or letter to the client, outlining the issue and response taken is strongly recommended as part of the overall action taken.

The number and nature of client complaints is reported by the QA Manager to the QA Director in the QA Monthly report. Monitoring and addressing the overall level and nature of client complaints and the effectiveness of the solutions is part of the Quality System Management Review (PHX-QA-050).

4.9 Control of Non-conformances

Non-conformances include any out of control occurrence. Non-conformances may relate to client specific requirements, procedural requirements, or equipment issues. All non-conformances in the laboratory are documented at the time of their occurrence on Corrective Action Reports (CARs), in the LIMS.

All non-conformances that affect a sample and/or sample data become part of the affected project's permanent record. When appropriate, reanalysis is performed where QC data falls outside of specifications, or where data appears anomalous. If the reanalysis comes back within established tolerances, the results are approved. If the reanalysis is still outside tolerances, further reanalysis or consultation with the Department Supervisor, Project Manager or QA Manager for direction may be required. All records of reanalysis are kept with the project files.

Where non-conformances specifically affect a client's sample and/or data, the client is informed and action must be taken. Action can take the form of reporting and flagging the data, and including a description of the non-conformance in the project narrative.

4.10 Corrective Action

To consistently achieve technical and regulatory requirements, the laboratory data must be supported by an effective corrective action system. The system must be capable of isolating and rectifying both random and systematic errors. Identification of systematic errors, or errors that are likely to occur repetitively due to a defect or weakness in a system, is particularly valuable in maintaining an environment of continuous improvement in laboratory operations.

Mechanisms used to ensure problem definition include SOPs; internal and external audits and surveillances; and regular laboratory management meetings. When evaluation of performance against established criteria for good laboratory practices shows a condition that could adversely affect the quality of services provided, corrective action is initiated.

Any employee in AEL can initiate an internal root cause investigation (IRCI). The initial source of corrective action can also be external to AEL (i.e., corrective action due to client complaint, regulatory audit, or PT(s)). When a problem that requires corrective action is identified, the following items are identified by the initiator on the IRCI: the nature of the problem, the name of the initiator, and the date. If the problem affects a specific client project, the PM is informed immediately.

All corrective actions, whether immediate or long-term, will comprise the following steps to ensure a closed-loop corrective action process:

- Define the problem.
- Assign responsibility for investigating the problem.
- Determine a corrective action to eliminate the problem.
- Assign, and obtain commitment to, and responsibility for implementing the corrective action.
- Implement the correction.
- Assess the effectiveness of the corrective action and verify that the corrective action has eliminated the problem.

4.10.1 Immediate Corrective Action

Immediate corrective actions to correct or repair non-conforming equipment and systems are generally initiated in response to adverse conditions identified through QC procedures. The analyst has relatively quick feedback that a problem exists, e.g., calibration does not meet or QC check samples exceed allowable criteria, and can take immediate action to repair the system.

The initial responsibility to monitor the quality of a function or analytical system lies with the individual performing the task or procedure. DQOs are evaluated against laboratory-established or against method or client specified QA/QC requirements. If the assessment reveals that any of the QC acceptance criteria are not met, the analyst must

immediately assess the analytical system to correct the problem. When the appropriate corrective action measures have been defined and the analytical system is determined to be "in-control" or the measures required to put the system "in-control" have been identified and scheduled, the problem and resolution or planned action is documented in the appropriate logbook or data package. Data generated by an analytical system that is determined to be out-of-control must never be released without approval of the Department Supervisor, QA Manager, Laboratory Director and client notification.

When an acceptable resolution cannot be met or data quality is negatively affected, the analyst will notify their Department Supervisor and initiate a CAR. If a CAR is required, it is routed for proper authorizations and direction. Proper authorization and direction is given by the Department Supervisor and/or QA Manager. Based upon the circumstances and judgment of the Project Manager, in conjunction with the QA Manager, the client will be notified of the situation.

Data generated concurrently with an out-of-control system will be evaluated for usability in light of the nature of the deficiency. If the deficiency does not impair the usability of the results, data will be reported and the deficiency will be noted in the case narrative. Where sample results may be impaired, the Project Manager is notified by a written CAR and appropriate corrective action (e.g., reanalysis) is taken and documented.

A CAR documents analytical problems at the bench level. This form allows for the documentation of the out-of-control situation, actions undertaken to correct the problem and a return-to-control status. All CARs are approved by the respective laboratory Department Supervisor.

All AEL employees have the authority to stop the analysis, e.g., failure to meet method or project requirements, and to hold all analyses of samples affected by an out-of-control situation. The method cannot be restarted without appropriate documentation leading to the Laboratory Director’s and/or QA Manager's approval.

4.10.2 Long-Term Corrective Action

Long-term corrective action is generally initiated due to QA issues, which are most often identified during internal and external audits (Sections 4.13 and 4.14). Typically, a deeper investigation into the root cause of the nonconformance is warranted, and the problem may take much longer to identify and resolve. Staff training, method revision, replacement of equipment, and LIMS reprogramming are examples of long-term corrective action.

4.10.3 Responsibility and Closure

The Department Supervisor is responsible for correcting out-of-control situations, placing highest priority on this endeavor. Associated corrective actions, once verified for effectiveness, are incorporated into standard practices. Ineffective actions will be documented and re-evaluated until acceptable resolution is achieved. Department Supervisors are accountable to the Operations Manager and Laboratory Director to ensure final acceptable resolution is achieved and documented appropriately.

The QA Manager also may implement a special audit (Section 4.13). The purpose of inclusion of the corrective action process in both routine and special audits is to monitor the implementation of the corrective action and to determine whether the action taken has been effective in overcoming the issue identified.

Any out-of-control situations that are not addressed acceptably at the laboratory level may be reported to the Corporate Quality Director by the QA Manager, indicating the nature of the out-of-control situation and problems encountered in solving the situation. This provides laboratory QA personnel non-laboratory management support, if needed, to ensure QA policies and procedures are enforced.

4.11 Preventative Action

The laboratory's preventive action programs improve, or eliminate potential causes of nonconforming product and/or nonconformance to the quality system. This preventive action process is a proactive continuous process improvement activity, which can be initiated by clients, employees, business providers, and affiliates. The QA section has the overall responsibility to ensure that the preventive action process is in place, and that relevant information on actions is submitted for management review.

Preventive action opportunities may be identified from information obtained through activities related to but not limited to the corrective action process, performance evaluation program, internal audits, management review, and/or market trends, industry trends and competitive comparisons.

Preventive actions are included in the Quality System Management Review (PHX-QA-050).

4.12 Records

4.12.1 Record Types

Record types are described in Table 5.

4.12.2 Record Retention

Data reports are filed electronically as .pdf files by work order. Hardcopy COC files are maintained and are filed by Work Order number.

Laboratory data, project management files, QA records (e.g., PT scores/corrective actions; MDLs/IDCs, statistical analysis, QAPPs, etc.), Human Resources information, etc., are compiled by date order. The same procedure is followed both in current and archived hardcopy storage.

Table 6 outlines the laboratory's standard record retention time. For raw data and project records, record retention is calculated from the date the project report is issued. For other records, such as Controlled Documents, QC, or Administrative Records, the retention time is calculated from the date the record is formally retired. Records related to the programs listed in Table 7 have lengthier retention requirements and are subject to the requirements in Section 4.12.3.

4.12.3 Programs with Longer Retention Requirements

Some regulatory programs and clients have longer record retention requirements than the laboratory's standard record retention time. These are detailed in Table 7 with their retention requirements and client-specific requirements are listed. In these cases, the longer retention requirement is implemented and noted in the archive. If special instructions exist such that client data cannot be destroyed prior to notification of the client, the container or box containing that data is marked as to who to contact for authorization prior to destroying the data.

Table 5. AEL Record Types

Raw Data	Controlled Documents	QC Records	Project Records	Administrative Records
See Section 3. Terms and Definitions	- LQM - QMP (Corporate) - QAPPs - SOPs - Work Instructions	- Audits – Internal - Audits - External - Audit Responses - Certifications - PTs - IRCIs - CARs - Review Checklists - Logbooks* - Standard Certificates - Method & Software Validation/Verification - MDL/IDL/IDOC Studies - Statistical Evaluations - Training Records - CDOC Evaluations - QA Reports - Electronic QA Files	- COCs - Contracts & Amendments - Correspondence - QAPP - SAP - Telephone Logs - E-mails - Electronic Data - Data Report	- Accounting - Corporate Safety Manual - Permits - Disposal Records - Employee Handbook - Personnel files - Employee Signature & Initials -Technical & Administrative Policies

[1] Record Types encompass hardcopy and electronic records.
[2] Examples of Logbook types: Maintenance, Instrument Run, Preparation (standard and samples), Standard and Reagent Receipt, Archiving, Balance Calibration, Temperature (hardcopy or electronic records).

Table 6. AEL Record Retention

Record Type[1]		Archival Requirement
Raw Data	All*	5 Years from analytical report issue
Controlled Documents	All*	5 Years from document retirement date
QA	All*	5 Years from archival
Project	All*	5 Years from analytical report issue
Administrative	Personnel/Training	7 years
	Accounting	See Accounting and Control Procedures Manual

[1] Record Types encompass hardcopy and electronic records.
* Exceptions listed in Table 7.

Table 7. Special Record Retention Requirements

Program	[1]Retention Requirement
Safe Drinking Water Data, associated Client reports and supporting documentation and software	12 years (Lead and Copper) 10 years (all other drinking water records)

[1]Note: Extended retention requirements must be noted with the archive documents or addressed in facility-specific records retention procedures.

4.12.4 Archives and Record Transfer

Archives are indexed such that records are accessible on either a project or temporal basis. Archives are protected against fire, theft, loss, deterioration, and vermin. Electronic records are protected from deterioration caused by magnetic fields and/or electronic deterioration. Access to archives is controlled and documented.

AEL ensures that all records are maintained as required by the regulatory guidelines and per this LQM upon facility location change or ownership transfer. Upon facility location change, all archives are retained by AEL in accordance with this LQM. Upon ownership transfer, all final test reports generated by the laboratory will be submitted to the clients if not previously provided. Any further record retention requirements will be addressed in the ownership transfer agreement and the responsibility for maintaining archives is clearly established.

In the event that the laboratory is closed, all final test reports generated by the laboratory will be submitted to the clients if not previously provided. All records will then be transferred to TestAmerica-STL's corporate record storage location. All boxes and contents will be appropriately labeled and managed in accordance their policies.

4.13 Internal Audits

Quality assurance audits and surveillances are conducted to assess the performance of laboratory systems in meeting technical, regulatory and client requirements; and to evaluate the operational details of the QA program (System Audits; S-Q-002). They provide a means for management to be apprised of, and to respond to, a potential problem before it actually impacts the laboratory operations. They also are a mechanism for ensuring closure of corrective actions resulting from external audits.

4.13.1 Audit Types and Frequency

A number of types of audits are performed at AEL. These audit types and frequency are categorized in Table 8.

Table 8. Audit Types and Frequency

Audit Type	Performed by	Frequency
Systems	QA Department or Designee	Annual
Data	QA Department or Designee	**Data Report Review:** As necessary to ensure an effective secondary review process
		Analyst Data Audits: 100% of all analysts annually
		Electronic Data Audits: 100% of all analytical instruments with electronic data file storage capability
Special	QA Department or Designee	As Needed

4.13.2 Systems Audits

Systems audits are technical in nature and are conducted on an ongoing basis by the QA Manager. Systems audits cover all departments of the facility, both operational and support. The review consists of laboratory systems, procedures, documentation and issues noted in external audits.

The audit report is issued by the QA Manager within 21 calendar days of the audit. The audit report is addressed to the Department Manager and copied to the Laboratory Director.

Written audit responses are required within 30 calendar days of the audit report issue. A maximum of one calendar month is given to address any recommended corrective actions. The audit response is directed to all individuals copied on the audit report. Where a corrective action may require longer than a calendar month to complete, the target date for the corrective action implementation is stated and evidence of the corrective action is submitted to the QA Department in the agreed upon time frame.

4.13.3 Data Audits

Data audits are focused to assess the level of customer service, SOP compliance, regulatory compliance, accuracy and completeness of test results and reports, documentation, and adherence to established QC criteria, laboratory SOPs, technical policy, and project specific QC criteria.

The QA Department provides feedback and/or corrections and revisions to project reports where necessary. Records of the data audits are kept, and the frequency of data audits is included in the monthly QA report. In performing data audits, it is essential that data be assessed in terms of differentiating between systematic and isolated errors. Upon noting anomalous data or occurrences in the data audits, the QA Department is responsible for seeking clarification from the appropriate personnel, ascertaining whether the error is systematic or an isolated error, and overseeing correction and/or revision of the project report if necessary. Errors found in client project reports are revised and the revision sent to the client (Section 4.8). The QA Department is also responsible for assisting in the corrective action process where a data audit leads to identification of the need for permanent corrective action.

The frequency of data auditing may also be dependent upon specific clients and regulatory programs. All active laboratory logbooks and QC files are subject to periodic audits/ surveillances by the QA personnel.

4.13.3.1 Data Authenticity Audits

Data authenticity audits shall be performed on 100% of all analysts by the QA department or a designee independent from the operations. Performing data authenticity checks will typically include verifying raw data, evaluating calculation tools and independently reproducing the final results and comparing it to the hardcopy on randomly selected batches of data. Analyst data audits must include spot-checking of manual integrations by QA personnel in order to determine that the manual integration is appropriate and documented according to Section 5.3.6. The laboratory will report the percentage of analysts reviewed (for the year) in their monthly QA report and should average about 8% per month.

4.13.3.2 Electronic Data Audits

Electronic data audits are performed on 100% of all analytical instruments with electronic data file storage capability by the QA department or a designee independent from the operations. This may include Mint Miner® scanning of randomly selected batches of electronic data followed by a chromatography system review. The QA Manager will report the percentage of instruments reviewed (for the year) in the monthly QA report and should average about 8% of instruments per month. Electronic data audits include spot-checking of manual integrations by QA personnel in order to determine that the manual integration is appropriate and documented according to Section 5.3.6.1.

4.13.4 Special Audits

Special audits are conducted on an as needed basis, generally as a follow up to specific issues such as client complaints, corrective actions, proficiency testing results, data audits, systems audits, validation comments, or regulatory audits. Special audits are focused on a specific issue, and report format, distribution, and timeframes are designed to address the nature of the issue.

4.14 External Audits

AEL is routinely audited by clients and external regulatory authorities – both government and non-government. Whether the audit is scheduled or unannounced, full cooperation with the audit team is provided by the laboratory and administrative staff. AEL recommends that the audits be scheduled with the QA Department so that all necessary personnel are available on the day of the audit.

4.15 Management Reviews

4.15.1 QA Reports to Management

A monthly QA report is prepared by the QA Manager and forwarded to the Laboratory Director and the Corporate Quality Director. The reports include statistical results that are used to assess the effectiveness of the quality system. The format of the monthly report is shown in Figure 3.

4.15.2 Quality Systems Management Review

A Quality Systems Management Review is performed at least annually by the QA Manager and the Laboratory Director. This review ensures that the laboratory's quality system is adequate to satisfy the laboratory's policies and practices, government requirements, certification, accreditation, approval requirements, and client expectations. Quality systems management reviews are accomplished through the evaluation and revision of this LQM, monthly quality assurance reporting and goal setting.

Management reviews of specific quality system elements may be performed through continuous improvement activities, monthly QA reports, process changes, SOP revisions, and/or audit reports/responses. Documentation of these reviews are not required unless it is inherent in the review mechanism (e.g., approval signatures on SOP revisions).

4.15.3 Monthly QA Report and Metrics

By the 5th day of the month, the QA Manager prepares a monthly QA report. The report is sent to the Laboratory Director and Corporate Quality Director. The report contains a narrative summary and metrics spreadsheet. At a minimum, the report content contains the items listed below (Figure 3). During the course of the year, the Laboratory Director or Corporate Quality Director may request that additional information be added to the report.

Figure 4. Monthly QA Report Format

1	**Audits**
	Internal System Audits External System Audits
2	**Revised Reports**
	Revised Reports Corrective/Preventive action measures
3	**Client Complaints/Compliments**
	Describe situations and resolutions in progress
4	**Certifications/Approvals**
	Issues/changes Lapses/potential revocations
5	**Proficiency Testing**
	Study participation and scores

	Combined PT scores Repeat failures
6	**SOP Status**
	Report the percentage of SOPs that have been revised or reviewed within the last 12 months for drinking water and within the last 24 months for all others
7	**Miscellaneous QA and Operational Issues**
	Narrative outlining improvements, regulatory compliance issues and general concerns
Appended	**Metrics Spreadsheet**
	Summarize metrics in the template provided by the Corporate Quality Director

5.0 Technical Requirements

5.1 Personnel

5.1.1 General

AEL management believes that its highly qualified and professional staff is the single most important aspect in assuring the highest level of data quality and service in the industry. The staff consists of professionals and support personnel that include the following positions:

- General Manager
- Laboratory Director
- Quality Assurance (QA) Manager
- Client Services Manager
- Operations Manager
- Department Supervisor
- Sample Receiving Manager
- Human Resources Specialist
- Administrative Assistant
- Project Manager
- Analyst
- Technician
- Quality Assurance Specialist
- EDD Specialist
- LIMS Analyst
- Courier
- Field Services Representative
- Receptionist

In order to ensure that employees have sufficient education and experience to perform a particular task, job descriptions are developed for all personnel. Job Descriptions are located on the STL Intranet Site's Human Resources web-page:

http://stlnet.stl-inc.com/Corporate/HR/JobDescriptions/JobDescrip_index.htm.

5.1.2 Training

AEL is committed to furthering the professional and technical development of employees at all levels. Selection of qualified candidates for laboratory employment begins with documentation of minimum education, training, and

experience prerequisites needed to perform the prescribed task. Minimum education and training requirements for AEL employees are outlined in Job Descriptions.

Orientation to the laboratory's policies and procedures, in-house method training, and employee attendance at outside training courses and conferences all contribute toward employee proficiency. The QA section in conjunction with the Human Resources section are responsible for maintaining documentation of these activities.

Each laboratory section is required to maintain documentation associated with analytical training (e.g., training records, IDOCs, CDOCs, and controlled documents). The QA department maintains documentation of method [and continued] proficiency (e.g., MDLs, PT Sample Tracking, Batch QC Chart/Data). This information is available to managers and staff for planning and evaluation.

The following evidence items are maintained in the employee's technical training file for each technical employee:

- DOC.
- The employee has read and understood the latest version of the laboratory's quality documentation.
- The employee has read and understood the latest, approved version of all test methods and/or SOPs for which the employee is responsible.
- Annual evidence of continued DOC that may include successful analysis of a blind sample on the specific test method, or a similar test method, or an annual DOC, or four successive, successful LCSs.

Human Resources maintains documentation and attestation forms on employment status & records; benefit programs; timekeeping/payroll; and employee conduct (e.g., ethics). This information is maintained in the employee's secured personnel file. This includes:

- An Ethics Agreement signed by each staff member (renewed each year).
- A Confidentiality Agreement signed by each staff member (renewed each year).

Table 9. AEL Employee Minimum Training Requirements

Specialty	Experience
General Chemistry and Instrumentation	Six months
Gas Chromatography	One year
Atomic Absorption	One year
Mass Spectrometry	One year
Spectra Interpretation	Two years

Required Training	Time Frame*	Employee Type
Environmental Health & Safety	Month 1	All
Ethics – New Hires	1-2 days of hire	All
Ethics - Comprehensive Data Integrity Quality Assurance	30 days of hire (All training)	All Technical and PMs All
Ethics Refresher	Annually	All
Initial Demonstration of Capability (DOC)	Prior to unsupervised method performance	Technical

**From date of initial employment unless otherwise indicated.*

The quality assurance training includes an overview of regulatory programs and program goals, a review of the ethics statement, and group discussions about data integrity and data misrepresentation.

When an analyst does not meet these requirements, they can perform a task under the supervision of a qualified analyst, peer reviewer or Department Supervisor, and are considered an analyst in training. The person supervising an analyst in training is accountable for the quality of the analytical data and must review and approve data and associated corrective actions.

IDOCs (Initial Demonstration of Method Capability) are performed by the analysis of four replicate QC samples. Results of successive LCS analyses can be used to fulfill the IDOC requirement. The accuracy and precision, measured as average recovery and standard deviation (using n-1 as the population), of the 4 replicate results are calculated and compared to those in the test method (where available). If the test method does not include accuracy and precision requirements, the results are compared to target criteria set by the laboratory. The laboratory sets the target criteria such that they reflect the DQOs of the specific test method or project. A IDOC Certification Statement is recorded and maintained in the employee's training file for NELAC analyses. Tabulated results summary and raw data are completed and signed by the analyst and Department Supervisor with the proper entries made onto the analysts training record. The data is submitted to the QA department for approval and entry into the master IDOC spreadsheet and filing. Figure 4 shows an example of a IDOC Certification Statement.

The requirement that a CDOC (Continued Demonstration of Capability) be presented for each method currently being analyzed must be presented for approval to QA in the same format as the IDOC discussed above.

5.1.3 Ethics Policy

Establishing and maintaining a high ethical standard is an important element of a Quality System. In order to ensure that all personnel understand the importance the company places on maintaining high ethical standards at all times; TestAmerica-STL has established an Ethics Policy, CA-L-P-001 and an Ethics Statement (Figure 5). Each employee signs the Ethics Statement, signifying agreed compliance with its stated purpose. The ethics statement is required to be re-signed on an annual basis.

Violations of this Ethics Policy will not be tolerated. Employees who violate this policy will be subject to disciplinary actions up to and including termination. Criminal violations may also be referred to the Government for prosecution. In addition, such actions could jeopardize the Company's ability to do work on Government contracts, and for that reason, the Company has a Zero Tolerance approach to such violations.

Ethics is also a major component of AEL's quality and data integrity systems. Each employee is trained in ethics within two weeks of hire and quality training within three months of hire. Annually, ethics refresher training will be provided. Employees are trained as to the legal and environmental repercussions that result from data misrepresentation. A data integrity hotline is maintained by TestAmerica-STL and administered by the Corporate Quality Director.

Figure 5. Example: Demonstration of Capability Certification Statement

Demonstration of Capability
Certification Statement

Date: Matrix:
Laboratory Name: Method:
Laboratory Address:
Analyst Name:

We the undersigned certify that:

1. The analyst identified above, using the cited test method, which is in use at this facility for the analysis of samples under the National Environmental Laboratory Accreditation Program, has met the Demonstration of Capability.
2. The test method was performed by the analyst identified on this certification.
3. Copies of the test method and SOP are available for all personnel on site.
4. The data associated with the DOC are true, complete and representative.
5. All raw data (including a copy of this certification form) necessary to reconstruct and validate these analyses have been retained at the facility, and that the associated information is available for review by authorized inspectors.

Laboratory Manager/Supervisor _____ Signature _____ Date _____

Figure 6. TestAmerica-STL Ethics Statement

TestAmerica-STL
EMPLOYEE ETHICS STATEMENT

I understand that TestAmerica-STL is committed to ensuring the highest standard of quality and integrity of the data and services provided to our clients. I have read the Ethics Policy of the Company.

With regard to the duties I perform and the data I report in connection with my employment at the Company, I agree that:

- *I will not intentionally report data values that are inconsistent with the actual values observed or measured;*
- *I will not intentionally report the dates, times, sample or QC identifications, or method citations of data analyses that are not the actual dates, times, sample or QC identifications, or method citations;*
- *I will not intentionally misrepresent another individual's work as my own or represent my own work as someone else's;*
- *I will not intentionally misrepresent any data where data does not meet Method or QC requirements. If it is to be reported, I will report it with all appropriate notes and/or qualifiers; I shall not modify data (either sample or QC data) unless the modification can be technically justified through a measurable analytical process, such as one deemed acceptable to the laboratory's Standard Operating Procedures, Quality Assurance Manual or Technical Director. All such modifications must be clearly and thoroughly documented in the appropriate laboratory notebooks/worksheets and/or raw data and include my initials or signature and date.*
- *I shall not make false statements to, or seek to otherwise deceive, members of Management or their representatives, agents, or clients/customers. I will not, through acts of commission, omission, erasure, or destruction, improperly report measurement standards, quality control data, test results or conclusions*
- *I shall not compare or disclose results for any Performance Testing (PT) sample, or other similar QA or QC requirements, with any employee of any other laboratory, including any other TestAmerica-STL laboratory, prior to the required submission date of the results to the person, organization, or entity supplying the PT sample.*
- *I shall immediately inform my supervisor or other member of management regarding any intentional or unintentional reporting of my own inauthentic data. Such report shall be given both orally and in writing to the supervisor or other member of management contacted and to the local Quality Assurance Officer/Manager. The Quality Assurance Officer/Manager will initial and date the information and return a copy to me; I shall not condone any accidental or intentional reporting of inauthentic data by other employees and will immediately report its occurrence. If I have actual knowledge of such acts committed by any other employees, and I do not report such information to designated members of Management, it shall be considered as serious as if I personally committed the offense. Accordingly, in that event, I understand that I may be subject to immediate termination of employment.*
- *I understand that if any supervisor, manager, or representative of TestAmerica-STL management instructs, requests, or directs me to perform any of the aforementioned improper laboratory practices, or if I am in doubt or uncertain as to whether or not such laboratory practices are proper, I will not comply. In fact, I must report such event to all appropriate members of Management including, but not limited to, the Lab Director, all supervisors and managers with direct line reporting relationship between me and the Lab Director, and the local Quality Assurance representative, excluding such individuals who participated in such perceived improper instruction, request, or directive. In addition, I may contact Corporate Quality Assurance / Ethics Compliance Officer(s) for assistance.*
- *I understand the critical importance of accurately reporting data, measurements, and results, whether initially requested by a client, or retained by TestAmerica-STL and submitted to a client at a later date, or retained by TestAmerica-STL for subsequent internal use;*
- *I will not share the pricing or cost data of Vendors or Suppliers with anyone outside of the TestAmerica-STL family of companies.*
- *I shall not accept gifts of a value that would adversely influence judgment.*
- *I shall avoid conflicts of interest and report any potential conflicts to the management (e.g. employment or consulting with competitors, clients, or vendors);*

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- *I shall not participate in unfair competition practices (e.g. slandering competitors, collusion with other labs to restrict others from bidding on projects);*
- *I shall not misrepresent certifications and status of certifications to clients or regulators;*
- *I shall not intentionally discharge wastes illegally down the drain or onto the ground.*
- *I understand that any attempt by management or an employee to circumvent these policies will be subject to disciplinary action.*

As a TestAmerica-STL employee, I understand that I have the responsibility to conduct myself with integrity in accordance with the ethical standards described in the Ethics Policy. I will also report any information relating to possible kickbacks or violations of the Procurement Integrity Act, or other questionable conduct in the course of sales or purchasing activities. I will not knowingly participate in any such activity and will report any actual or suspected violation of this policy to management.

I understand that if my job includes supervisory responsibilities, I shall not instruct, request, or direct any subordinate to perform any laboratory practice which is unethical or improper. Also, I shall not discourage, intimidate, or inhibit an employee who may choose to appropriately appeal my supervisory instruction, request, or directive which the employee perceives to be improper, nor retaliate against those who do.

The Ethics Policy has been explained to me by my supervisor or at a training session, and I have had the opportunity to ask questions if I did not understand any part of it. I understand that any violation of this policy subjects me to disciplinary action, which can include termination. In addition, I understand that any violation of this policy which relates to work under a government contract or subcontract could also subject me to the potential for prosecution under federal law.

EMPLOYEE SIGNATURE _____ Date _____

Supervisor/Trainer: _____ Date _____

5.2 Facilities

The laboratory is a secure facility with controlled and documented access. Access is controlled by various measures including locked doors, and a staffed reception area. All visitors sign in and are escorted by AEL personnel while at the facility. The laboratory is locked at all times, unless a receptionist is present to monitor building access (e.g., between the hours of 8:00 a.m. and 5:00 p.m. Monday through Friday).

The facility is designed for efficient, automated high-quality operations. The laboratory is equipped with Heating, Ventilation, and Air Conditioning (HVAC) systems appropriate to the needs of environmental testing laboratories. Environmental conditions in the facility, such as hood flow, are routinely monitored and documented.

The facility is equipped with structural safety features. Each employee is familiar with the location, use, and capabilities of general and specialized safety features associated with their workplace. AEL also provides and requires the use of protective equipment including safety glasses, protective clothing, gloves, etc.

5.3 Test Methods

Routine analytical services are performed using standard EPA, NIOSH and OSHA-approved methodology. In some cases, modification of standard approved methods may be necessary to provide accurate analyses of particularly complex matrices.

5.3.1 Method Selection

Since numerous methods and analytical techniques are available, continued communication between the client and laboratory is imperative to assure the correct methods are utilized. Once client methodology requirements are established, this and other pertinent information is summarized by the Project Manager in a technical profile. These mechanisms ensure that the proper analytical methods are applied when the samples arrive for log-in. For non-routine analytical services (e.g., special matrices, non-routine compound lists, etc.), the method of choice is selected based on client needs and available technology.

Most of the test methods performed at AEL originate from test methods published by a regulatory agency such as the US EPA, NIOSH, OSHA and other state and federal regulatory agencies. These include, but are not limited to, the following published compendiums of test methods.

Method 1664, Revision A: N-Hexane Extractable Material (HEM; Oil and Grease) and Silica Gel Treated N-Hexane Extractable Material (SGT-HEM); Non-polar Material) by Extraction and Gravimetry, EPA-821-R-98-002, February 1999.

Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, US EPA, January 1996, and updates.

Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act, and Appendix A-C; 40 CFR Part 136, USEPA Office of Water.

Methods for Chemical Analysis of Water and Wastes, EPA 600 (4-79-020), 1983.

Methods for the Determination of Inorganic Substances in Environmental Samples, EPA-600/R-93/100, August 1993.

Methods for the Determination of Metals in Environmental Samples, EPA/600/4-91/010, June 1991. Supplement I: EPA-600/R-94/111, May 1994.

Methods for the Determination of Organic Compounds in Drinking Water, EPA-600/4-88-039, December 1988, Revised, July 1991, Supplement I, EPA-600-4-90-020, July 1990, Supplement II, EPA-600/R-92-129, August 1992.

NIOSH Manual of Analytical Methods, 4th ed., August 1994, and updates.

Standard Methods for the Examination of Water and Wastewater, 20th edition; Eaton, A.D. Clesceri, L.S. Greenberg, A.E. Eds; American Water Works Association, Water Pollution Control Federation, American Public Health Association: Washington, D.C.

Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW846), Third Edition, September 1986, Final Update I, July 1992, Final Update IIA, August 1993, Final Update II, September 1994; Final Update IIB, January 1995; Final Update III, December 1996; Update IIIA, June 1999; and Update IIIB, July 2005, available from National Technical Information Service and at http://www.epa.gov/epaoswer/hazwaste/test/main.htm..

The laboratory reviews updated versions to all the aforementioned references for adaptation based upon capabilities, instrumentation, etc., and establishes an implementation schedule. As such, the laboratory strives to perform only the latest versions of each approved method.

5.3.2 SOPs

AEL maintains a SOP master listing (SOP Expiration Date Tracking; PHX-QA-051) for both Method and Process SOPs. Method SOPs are maintained to describe a specific test method. Process SOPs are maintained to describe function and processes not related to analytical testing (e.g., administrative procedures).

SOPs contain the following information, but not necessarily in the order listed:

Title Page with Document Name, SOP Number/Revision, Date Issued, Expiration Date, Page Numbers and Total Number of Pages, Authorized Signatures, and Dates.

1. Identification of Test Method
2. Applicable Matrix
3. Scope and Application, including test analytes
4. Summary of the Test Method
5. Reporting Limits
6. Definitions
7. Interferences
8. Safety
9. Equipment and Supplies
10. Reagents and Standards
11. Sample Collection, Preservation and Storage
12. Quality Control
13. Calibration and Standardization
14. Procedure
15. Calculations
16. Method Performance (NELAC SOPs)
17. Safety
18. Data Assessment and Acceptance Criteria for Quality Control Measures
19. Corrective Actions for Out-of-Control Data
20. Contingencies for Handling Out-of-Control or Unacceptable Data
21. Hazardous Waste Management and Pollution Prevention
22. References
23. Tables, Diagrams, Flowcharts and Validation Data

The respective analytical department and QA are responsible for maintenance of SOPs. The QA Department is responsible for archival of SOP historical revisions, maintenance of an SOP master listing, and records of controlled distribution. SOPs, at a minimum, are reviewed every 24 months. Drinking Water SOPs are reviewed annually. Where an SOP is based on a published method, the laboratory maintains a copy of the reference method.

Figure 7. Proprietary Information Statement

SOP Change Form

The SOP Change Form is used for implementation, documentation, and authorization of changes to SOPs (SOP Change Form; PHX-QA-006). Immediate changes in SOPs may be necessary to accommodate improvements; to implement acceptable changes in practices; or to correct potential errors in the existing version. The reason for the change will be identified and a detailed description of the procedure change will be presented. Since this form will become part of the referenced SOP, until such time that the SOP is updated, it must be legible and comprehensible. The Change Form must provide an exact description and identify the affected sections.

Once this form is completed and changes are authorized, it becomes an official part of the SOP for which it revises, and is subject to all document control and records management policies.

5.3.3 Method Validation

Laboratory developed methods are validated and documented according to the procedure described in Section 5.3.5.

5.3.4 Method Verification

Method verification is required when a validated standard test method or a method modification is implemented. The level of activity required for method verification is dependent on the type of method being implemented, or on the level of method modification and its affect on a method's robustness. Method modification often takes advantage of a method's robustness, or the ability to make minor changes in a method without affecting the method's outcome.

It is the responsibility of the Department Supervisor to present to the QA Manager all applicable method validation studies for review and approval. The documented approval by the Department Supervisor and QA Manager must be applied to all applicable validation records before the method is released for use. Method verification may require some, but not all, of the activities described in Section 5.3.5.

5.3.5 Method Validation and Verification Activities

Before analyzing samples by a particular method, method validation and/or method verification must occur. A complete validation of the method is required for laboratory developed methods. While method validation can take various courses, the following activities can be required as part of method validation. Method validation records are designated QC records and are archived accordingly.

Determination of Method Selectivity
Method selectivity is demonstrated for the analyte(s) in the specific matrix or matrices. In some cases, to achieve the required selectivity for an analyte, a confirmation analysis is required as part of the method.

Determination of Method Sensitivity
Sensitivity can be both estimated and demonstrated. Whether a study is required to estimate sensitivity depends on the level of method development required when applying a particular measurement system to a specific set of samples. Where estimations and/or demonstrations of sensitivity are required by regulation or client agreement, such as the procedure in 40 CFR Part 136 Appendix B, under the Clean Water Act, these shall be followed. The laboratory determines MDLs are described in Section 4.4.3.6, the corporate procedure S-Q-003, and the laboratory MDL Studies SOP (09-010).

Relationship of Limit of Detection (LOD) to the Quantitation Limit (QL)
An important characteristic of expression of sensitivity is the difference in the LOD and the QL. The LOD is the minimum level at which the presence of an analyte can be reliably concluded. The QL is the minimum level at which both the presence of an analyte and its concentration can be reliably determined. For most instrumental measurement systems, there is a region where semi-quantitative data is generated around the LOD (both above and below the estimated MDL or LOD) and below the QL. In this region, detection of an analyte may be confirmed but quantification of the analyte is unreliable within the accuracy and precision guidelines of the measurement system. When an analyte is detected below the QL, and the presence of the analyte is confirmed by meeting the qualitative identification criteria for the analyte, the analyte can be reliably reported, but the amount of the analyte can only be estimated. If data is to be reported in this region, it must be done so with a qualification that denotes the semi-quantitative nature of the result.

Determination of Interferences
A determination that the method is free from interferences in a blank matrix is performed.

Determination of Range
Where appropriate, a determination of the applicable range of the method may be performed. In most cases, range is determined and demonstrated by comparison of the response of an analyte in a curve to established or targeted criteria. The curve is used to establish the range of quantitation and the lower and upper values of the curve represent upper and lower quantitation limits. Curves are not limited to linear relationships.

Demonstration of Capability
DOCs are performed prior to method performance.

Determination of Accuracy and Precision
Accuracy and precision studies are generally performed using replicate analyses, with a resulting percent recovery and measure of reproducibility (standard deviation, relative standard deviation) calculated and measured against a set of target criteria.

Documentation of Method
The method is formally documented in an SOP. If the method is a minor modification of a standard laboratory method that is already documented in an SOP, an SOP Appendix describing the specific differences in the new method is acceptable in place of a separate SOP.

Continued Demonstration of Method Performance
Continued Demonstration of Method Performance is addressed in the SOP. Continued demonstration of method performance is generally accomplished by batch specific QC samples such as LCS and Method Blanks.

5.3.6 Data Reduction and Review

Analytical data are entered/downloaded directly into LIMS or recorded on pre-formatted bench sheets that are paginated and bound into laboratory logbooks. These logbooks are issued and controlled by the laboratory's QA Department. A unique document control code is assigned to each book to assure that chronological record keeping is maintained. Analytical data may be electronically stored as a secure .pdf file.

Analytical data is referenced to a unique sample identification number for internal tracking and reporting. Both LIMS entries and logbook pages contain the following information, as applicable: analytical method, analyst, date, sequential page number, associated sample numbers, standard concentrations, instrument settings, and raw data. Entries are in chronological order and maintained so as to enable reconstruction of the analytical sequence.

The analyst is responsible for entering / recording all appropriate information, and for signing and dating all logbook entries daily. All entries and logbook pages are reviewed for completeness by a supervisor, peer reviewer or the analyst themselves. Data review checklists document the analytical review of the LIMS entries, logbook and associated QC indicators. Copies of instrument outputs (chromatograms, mass spectra, etc.) are maintained on file or electronically with the analyst's signature/initials and date.

5.3.6.1 Data Reduction

The complexity of the data reduction depends on the analytical method and the number of discrete operations involved (e.g., extractions, dilutions, instrument readings and concentrations). The analyst calculates the final results from the raw data or uses appropriate computer programs to assist in the calculation of final reportable values.

For manual data entry, e.g., General Chemistry, the data is reduced by the analyst and then verified by the Department Supervisor or alternate analyst prior to approving the data in LIMS. The spreadsheets, or any other type of applicable documents, are signed/initialed by both the analyst and alternate reviewer to confirm the accuracy of the manual entry(s).

Manual integration of peaks will be documented and reviewed and the raw data will be flagged in accordance with the TestAmerica-STL and AEL SOPs (Acceptable Manual Integration Practices; S-Q-004 and Manual Integrations; 09-023).

Copies of all raw data and the calculations used to generate the final results, such as bound logbooks, are retained on file for a minimum of 5 years or as otherwise requested by the client/project (see Tables 6 and 7).

Calculations and data reduction steps for various methods are summarized in the respective analytical SOPs or program requirements.

5.3.6.2 Data Review

All data, regardless of regulatory program or level of reporting, are subject to a thorough review process. The individual analyst continually reviews the quality of the data through calibration checks, quality control sample results and performance evaluation samples. Data review is initiated by the analyst during, immediately following, and after the completed analysis.

All levels of the review are documented on Data Review Checklists that are specific to each analytical method as identified in the respective SOP.

Primary Review

The primary review is often referred to as a "bench-level" review. In most cases, the analyst who generates the data (e.g., logs in, prepares and/or analyzes the samples) is the primary reviewer. In some cases, an analyst may be reducing data for samples run by an auto-sampler set up by a different analyst. In this case, the identity of both the analyst and the primary reviewer is identified in the raw data.

One of the most important aspects of primary review is to make sure that the test instructions are clear, and that all project specific requirements have been understood and followed.

Once an analysis is complete, the primary reviewer ensures, where applicable, that:

- Sample preparation information is complete, accurate, and documented.
- Calculations have been performed correctly.
- Quantitation has been performed accurately.
- Qualitative identifications are accurate.
- Manual integrations are appropriate.
- Data flags to indicate manual integrations are recorded.
- Manual integrations are authorized by a date and signature or initials (hardcopy or electronic) of primary analyst.
- Client specific requirements have been followed.
- Method and process SOPs have been followed.
- Method QC criteria have been met.
- QC samples are within established limits.
- Dilution factors are correctly recorded and applied.
- Non-conformances and/or anomalous data have been properly documented and appropriately communicated.
- COC procedures have been followed.
- All unused portions of hardbound logbooks are 'Z'ed out; corrections are made with a single line drawn through the error and are dated and initialed.
- Primary review is documented by date and initials/signature of primary analyst.

Any anomalous results and/or non-conformances noted during the Primary Review are documented on the logbook, the Data Review Checklist and/or on a CAR; and are communicated to the Department Supervisor and the Project Manager for resolution. Resolution can require sample reanalysis, or it may require that data be reported with a qualification. Non-conformances are documented per Section 4.9.

Secondary Review

The secondary review is also a complete technical review of a data and is performed by the Department Supervisor, analyst or data specialist. The secondary review is documented on the same logbook, Data Review Checklist and/or CAR as the primary review.

The following items are reviewed:

- Qualitative Identification.
- Quantitative Accuracy.
- Calibration.
- QC Samples.
- Method QC Criteria.
- Adherence to method and process SOPs.
- Accuracy of Final Client Reporting Forms.

- Manual Integrations – Minimal requirement is to spot-check raw data files for manual integration, as verified by date and initials or signature (hardcopy or electronic) of secondary data reviewer. Some regulatory programs require 100% secondary review of manual integrations.
- Completeness.
- Special Requirements/Instructions.

If problems are found during the secondary review, the reviewer must work with the appropriate personnel to resolve them. If changes are made to the data, such as alternate qualitative identifications, identifications of additional target analytes, re-quantitation, or re-integration, the secondary reviewer must contact the laboratory analyst and/or primary reviewer of the data so that the primary analyst and/or reviewer is aware of the appropriate reporting procedures.

Completeness Review

The completeness review includes the generation of a project narrative and/or cover letter, which outlines anomalous data and non-compliances using project narrative notes and CARs generated during the primary and secondary review. The completeness review addresses the following items:

- Is the project report complete?
- Does the data meet with the client's expectations?
- Were the data quality objectives of the project met?
- Are QC outages and/or non-conformances approved and appropriately explained in the narrative notes?

The laboratory Department Supervisor(s), and the Project Manager contribute to the completeness review.

5.3.7 Data Integrity and Security

This section details those procedures that are relevant to computer systems that collect, analyze, and process raw instrumental data, and those that manage and report data.

Security and Traceability

Access to the laboratory's LIMS system, that collects, analyzes, and processes raw instrumental data, and those that manage and report data is both controlled and recorded. System users are granted access levels that are commensurate with their training and responsibilities.

Control of the system is accomplished through limitation of access to the system by users with the education, training and experience to perform the task knowledgeably and accurately. System users are granted privileges that are commensurate with their experience and responsibilities.

Computer access is tracked by using unique login names and passwords for all employees that have access to the computer system. Entries and changes are documented with the identity of the individual making the entry, and the time and date. Where a computer system is processing raw instrumental data, the instrument identification number as described in Section 5.4.1 is recorded. The system has the capability of maintaining audit trails to track entries and changes to the data. This function is activated on any computer system that has that capability (e.g., Enviroquant, Chemstation).

Verification

Verification involves assessing whether the computer system accurately performs its intended function. Verification generally is accomplished by comparing the output of the program with the output of the raw data manually processed, or processed by the software being replaced.

Verification of instrumental software was also completed at the time of implementation, either by way of manual comparison to computer generated data or comparison to data generated by the previous system being replaced.

The above procedures do not apply to general purpose software, except where those applications are used to perform calculations in support of client data. In those cases, verification will be required.

Validation
Software validation involves documentation the verification of final calculated results. Software validation is performed by the QA department on all in house programs. Records of validation are retained as QC records.

Version Control
The laboratory maintains copies of outdated versions of software and associated manuals for all software in use at the laboratory for a period of 5 years from its retirement date. The associated hardware, required to operate the software, is also retained for the same time period.

5.4 Equipment

5.4.1 Equipment Operation

AEL is committed to routinely updating and automating instrumentation. The laboratory maintains state of the art instrumentation to perform the analyses within the QC specifications of the test methods. The laboratory maintains a Master Equipment List (PHX-QA-049) for each piece of equipment and instrumentation that documents the following information:

- Identity
- Date In Service
- Manufacturer's Name, Model Number, Serial Number
- Current Location
- Equipment Status

All equipment is subject to rigorous checks upon its receipt, upgrade, or modification to establish that the equipment meets with the selectivity, accuracy, and precision required by the test method for which it is to be used. All manufacturer's operations and maintenance manuals are kept up to date and accessible for the use of the equipment operator. Documentation of equipment usage is maintained using analytical run and maintenance logbooks.

5.4.2 Equipment Maintenance

AEL employs a system of preventative maintenance in order to ensure system up time, minimize corrective maintenance costs and ensure data validity. Routine maintenance may be performed by an analyst, instrument specialist or outside technician. Maintenance logbooks are kept on all major pieces of equipment in which both routine and non-routine maintenance is recorded.

Any item of equipment or instrumentation that has been subjected to overloading or mishandling, provides suspected results, has been shown by verification or otherwise to be defective, is new or not been used for an extended period of time, is taken out of services and tagged as "OUT OF SERVICE". The tag is signed/dated by the person removing the item from service and noted as to the reason of in-operation.

Any instrumentation that is brought back on-line must have MDLs and DOCs performed and have acceptance within prescribe criteria; or calibrated by a certified agency (e.g., balances or Class S weights); and proven to provide consistent measurements (e.g., refrigerators, eppendorf pipettes, ovens).

The return to analytical control following instrument repair is documented in the maintenance logbook. Notation of the date and maintenance activity is recorded each time service procedures are performed. Maintenance logbooks are retained as QA records.

Maintenance contracts are held on specific pieces of equipment where outside service is efficient, cost-effective, and necessary for effective operation of the laboratory.

5.4.3 Equipment Verification and Calibration

All equipment is calibrated prior to use (Initial Calibration) to establish its ability to meet the QC guidelines contained in the test method for which the instrumentation is to be used. All sample measurements are made within the calibrated range of the instrument and in compliance with method requirements. The calibration data, which includes instrument conditions and standard concentrations, is documented in pre-formatted instrument run logs. The preparation of all reference materials used for calibration is documented in pre-formatted standards logs.

Once an instrument is calibrated, ongoing instrument calibration is demonstrated (Continuing Calibration) at the appropriate frequency as defined in the test method. Refer to the TestAmerica-STL Corporate Policy *Selection of Calibration Points* (P-T-001), for guidance on using calibration data. Any instrument that is deemed to be malfunctioning is clearly marked and taken out of service. When the instrument is brought back into control, acceptable performance is documented.

5.4.3.1 Instrument Calibration

Specific instrument calibration procedures for various instruments are summarized further in this section, and detailed in the respective analytical methods. Typically, more than one analytical method is available for an analysis. These various methods and other program requirements (e.g., U.S. EPA, AIHA, QAPPs, contracts, etc.) may specify different calibration requirements. Therefore, calibration details as specified in the respective laboratory SOPs, QAPP, program requirements, and contracts supersede the general instrument calibration procedures are described further in Table 10. Complete details are provided in each method SOP.

Table 10. Minimum Instrument Calibration Procedures

Technique	Activity	Minimum Requirements
Metals (ICP)	Initial Calibration	Following a period of time sufficient to warm up the instrument, the ICP is calibrated prior to each analytical run or minimally every 24 hours. Calibration standards are prepared from reliable reference materials and contain all metals for which analyses are being conducted. Working calibration standards are prepared fresh daily. On a day-to-day basis, 4 calibration standards (blank, high standard, 50% standard, and 20% standard) are analyzed. Prior to an analytical run, the instrument is calibrated using three standards. An Initial Calibration Verification (ICV) standard is analyzed immediately after standardization, followed by an Initial Calibration Blank (ICB). The ICV is from a source other than that used for initial calibration and the ICB must be free of target analytes at and above the value to be reported or appropriate corrective action must be taken. ICP Interference Check Samples (ICSA/ICSAB) are analyzed at the frequency described in each method SOP.

Table 10. Minimum Instrument Calibration Procedures

Technique	Activity	Minimum Requirements
	Continuing Calibration	The initial calibration is verified during the analysis sequence by analysis of a Continuing Calibration Verification (CCV) standard and a Continuing Calibration Blank (CCB). The response of the CCV must be within the SOP-specified criteria (e.g., ± 10% recovery of the true value). The CCB must be free of target analytes at or above the value to be reported or appropriate corrective action must be taken. If any ICVs/CCVs or blanks exceed their acceptance criteria, appropriate corrective action must be taken.
Cold Vapor Atomic Absorption (CVAA)	Initial Calibration	Initial calibration will include analysis of a calibration blank and a minimum of four (4) calibration standards (blank, and three standards) covering the anticipated range of measurement. Duplicate injections (GFAA) are made for each concentration. Response readings, e.g., absorbance, are recorded and the resultant standard calibration curve calculated. If the SOP or program-specified criteria are not met, appropriate corrective action must be taken. An ICV standard will be analyzed immediately after standardization. The ICV must be within SOP-specified criteria (e.g., ±5% of the true value for drinking water, and ±10% in most other cases), or the initial calibration must be repeated. The ICV must be from a source other than that used for initial calibration. An ICB will be analyzed after the ICV. The ICB must be free of target analytes at and above a concentration in which sample results are reported, or corrective action must be taken.
	Continuing Calibration	The initial calibration is verified during the analysis sequence by evaluation of a CCV standard and a CCB, as described above. The CCV value must be within SOP-specified criteria (e.g., ±10% recovery of the true value except for mercury within ±20 % of the true value). The CCB must be free of target analytes at or above the concentration reported in samples. If any CCV or CCB exceed their acceptance criteria, corrective action must be taken.
Inorganic Colorimetric Methods	Initial Calibration	An initial standard calibration curve will be prepared for all colorimetric analyses on a daily basis. Working standards to define this curve will include a minimum of three (3) concentrations which cover the linear range of the method, plus a calibration blank. At least one of the calibration standards will be at a concentration which will enable verification of instrument response at the reporting limit as defined in Section 8.6 or a level suitable for meeting specific program requirements. The requirement for an acceptable initial calibration is described in the analytical SOP. If the criteria are not met, appropriate corrective action must be taken. Calibration data, e.g., correlation coefficient, is entered into the laboratory notebook, or associated instrument printouts, and retained with the sample data. In lieu of an initial curve, a daily calibration verification check may be analyzed. This calibration check will at a minimum consist of a blank and a mid-range standard. Results must be within SOP-specified criteria. If not, reanalysis of the standards may be done once to verify the readings; otherwise, a new curve will be developed.
		For procedures that require pretreatment steps, a minimum of one standard shall be prepared with the pretreatment. If the pre-treated standard is within SOP-specified criteria, the curve will be used. If the pre-treated sample is not within the criteria, the reason will be determined. If it is determined that the difference between the curves is inherent in the procedure, the curve will be based on the standards prepared and carried through the pretreatment. An ICV will be analyzed immediately after the standardization, followed by an ICB. The ICV must be from a source other than that used for initial calibration. The ICV must be within SOP-specified criteria and the ICB must be free of target analytes or appropriate corrective action must be taken.

Table 10. Minimum Instrument Calibration Procedures

Technique	Activity	Minimum Requirements
	Continuing Calibration	The initial calibration is verified after every 10 field samples and at the end of the analytical shift, with the analysis of a continuing calibration verification standard (CCV) and a blank (CCB). If any CCV or CCB exceed SOP-specified acceptance criteria, appropriate corrective action is taken per SOP. All samples since the last valid calibration verification check are reanalyzed.
Ion Chromato-graphy	Initial Calibration	The ion chromatograph will be calibrated approximately monthly or when any significant change is made to the system. Calibration standards will be prepared from appropriate reference materials and will include a blank and a minimum of three concentrations to cover the linear range of the instrument. At least one of the calibration standards will be at a concentration, which will enable verification of instrument response at the reporting limit. If SOP-specified calibration criteria cannot be achieved, appropriate corrective action must be taken. Calibration data, e.g., correlation coefficient, will be archived with sample raw data. An ICV will be analyzed on a daily basis, prior to sample analysis and followed by an ICB. The ICV must be from a source other than that used for initial calibration. The ICV must be within SOP-specified criteria and the ICB must be free of target analytes or appropriate corrective action must be taken.
	Continuing Calibration	The initial calibration is verified after every 10 readings and at the end of the analytical shift, with the analysis of a continuing calibration verification standard (CCV) and a blank (CCB). If any CCV or CCB exceed SOP-specified acceptance criteria, appropriate corrective action is taken per SOP. All samples since the last valid calibration verification check are reanalyzed.
GC/MS		All GC/MS instrumentation is calibrated to set specifications prior to sample analysis. These specifications vary depending on the requirements of the analytical program and the designated analytical method.
	Tuning and Mass Calibration	Mass spectrometers are calibrated with perfluorotributylamine (FC-43) or perfluorophenanthrene (FC- 5311) as required to ensure correct mass assignment. In addition, at the beginning of the daily work shift, the GC/MS system must be tuned with decafluorotriphenylphosphine (DFTPP) for semivolatiles analysis and 4-bromofluorobenzene (BFB) for volatiles analysis, and calibrated to target compounds.
		The majority of the laboratory work utilizes U.S. EPA-CLP or SW-846 protocols, which define the work shift as a 12-hour period initiated by the injection of DFTPP or BFB. For wastewater programs (600 series methods), the tune expires after 24 hours. Ion abundances will be within the windows dictated by the specific program requirements.

Table 10. Minimum Instrument Calibration Procedures

Technique	Activity	Minimum Requirements
GCMS	Initial Calibration	After an instrument has been tuned, initial calibration curves (minimum of 3-5 points) are generated for the compounds of interest. The low level standard must be at a concentration which will enable verification of instrument response near the reporting limit or at a concentration acceptable to meet program requirements. The other standards must extend through the linear working range of the detector. The parameters requiring quantitation must meet SOP or program-specified criteria prior to initiation of sample analysis. Any sample extracts containing parameters of interest which exceed the concentration of the high level standard, must be diluted to bring the parameters within the range of the standards. Instrument response to these target compounds are evaluated against SOP-specified criteria. Linearity is verified by evaluating the response factors (RF) for the initial calibration standards against SOP-specified criteria. Once an acceptable calibration is obtained, samples may be analyzed up until the expiration of the tune. At that time, the instrument must be re-tuned prior to further analysis. After acceptable tuning, a continuing calibration standard may be analyzed in lieu of a full multi-point calibration if the SOP-specified criteria are met. The majority of compounds analyzed for GC/MS comprise EPA's Target Compound List (TCL) or Priority Pollutant List (PPL). For add-on compounds not on the current TCL or PPL, initial calibration may be performed using a single point calibration of the additional compound(s), unless prior arrangements are made for a full three-to-five point calibration. Calibration data, to include linearity verification, will be maintained in the laboratory's records of instrument calibrations.
	Continuing Calibration	During each operating shift, a single calibration standard may be analyzed to verify that the instrument responses are still within the initial calibration determinations, as defined in the specific SOPs. If criteria cannot be met, appropriate corrective action must be taken.
GC and HPLC		Gas chromatographs and high performance liquid chromatographs will be calibrated prior to use as described in analytical SOP or program requirements. Calibration standard mixtures will be prepared from appropriate reference materials and will contain analytes appropriate for the method of analysis or program requirements.
	Initial Calibration	Initial calibration will include a minimum of 3 to 5 calibration standards covering the anticipated range of measurement. The low level standard must be at a concentration which will enable verification of instrument response near the reporting limit or at a concentration acceptable to meet program requirements. The other standards must extend through the linear working range of the detector. The parameters requiring quantitation must meet SOP or program-specified criteria prior to initiation of sample analysis. Any sample extracts containing parameters of interest which exceed the concentration of the high level standard, must be diluted to bring the parameters within the range of the standards.

Table 10. Minimum Instrument Calibration Procedures

Technique	Activity	Minimum Requirements
GC and HPLC	Continuing Calibration	The response of the instrument will be verified for each analysis sequence by evaluation of a daily calibration verification standard at a mid-range concentration. In order to demonstrate that the initial calibration curve is still valid, the calibration check standard must be within SOP or program-specified acceptance criteria for the compounds of interest or the instrument must be recalibrated. For multi-analyte methods, this check standard may contain a representative number of target analytes rather than the full list of target compounds. Optionally, initial calibration (e.g., the full range of concentration levels) can be performed at the beginning of the analysis sequence. Within the analysis sequence, instrument drift will be monitored by analysis of a mid-range calibration standard of varying concentrations every ten samples or 12 hour sequence (depending on the method protocol), including external QC. If the SOP or program-specified calibration criteria are not met for the compounds of interest, appropriate corrective action must be taken.

5.5 Measurement Traceability

5.5.1 General

Traceability of measurements is assured using a system of documentation, calibration, and analysis of reference standards. Laboratory equipment that are peripheral to analysis and whose calibration is not necessarily documented in a test method analysis or by analysis of a reference standard is subject to ongoing certifications of accuracy.

At a minimum, these include procedures for checking specifications for balances, thermometers, temperature, De-ionized (DI) water systems, automatic/eppendorf pipettes and other volumetric measuring devices. Wherever possible, subsidiary or peripheral equipment is checked against standard equipment or standards that are traceable to national or international standards [with the exception of class A glassware (including glass microliter syringes that have a certificate of accuracy)].

An external certified service engineer services laboratory balances on an annual basis. This service is documented on each balance with a signed and dated certification sticker. Balances are calibrated on each day of use in the applicable Daily Balance Calibration Verification Logbook (PHX-QA-008). All thermometers and temperature monitoring devices are calibrated semi-annually for microbiological thermometers or annually (all others) against a traceable reference thermometer. Temperature readings of ovens, refrigerators, and incubators are checked on each day of use and recorded in the applicable logbook or log form (Daily Temperature Log; PHX-QA-025).

The laboratory DI water system has documented preventative maintenance schedules and the conductivity of the water is recorded on each day of use (Nanopure – Conductivity Check; PHX-CH-035 and DI Water System Maintenance Logbook; PHX-MC-001).

5.5.2 Reference Standards

The receipt of all reference standards is documented in the respective Standard logbook. Standards are obtained from commercial vendors and sources may vary depending upon the availability of mixes and solutions from vendors. Each production unit is responsible to ensure, when available, that all standards are traceable to EPA, NIST, A2LA, SARMs and are accompanied by a Certificate of Analysis that documents the standard purity. If a

standard cannot be purchased from a vendor that supplies a Certificate of Analysis, the purity of the standard is documented by analysis.

The receipt of each dry chemical, purchased stock solution or reference material to be used as a standard is assigned a unique ID number (Dry Chemical/Solvent/Wet Chemical Receipt Logbook; PHX-SM-009). The chemical name, manufacturer, lot number, date received, expiration date, date opened and initials of the analyst who opened the chemical are documented. The expiration dates for ampulated solutions shall not exceed the manufacturer's expiration date. Expiration dates for laboratory-prepared stock and diluted standards shall be no later than the expiration date of the stock solution or material or the date calculated from the holding time allowed by the applicable analytical method, whichever comes first. Expiration dates for pure chemicals shall be established by the laboratory and be based on chemical stability, possibility of contamination, and environmental and storage conditions. Expired standard materials shall be either revalidated prior to use or discarded. Revalidation may be performed through assignment of a true value and error window statistically derived from replicate analyses of the material as compared to an unexpired standard. The laboratory labels all standard and QC materials with expiration dates.

The preparation of all daughter solutions, whether a single or multiple-component stock, intermediate, or working standard solution, is documented in a standard solution preparation logbook, or in a designated section of the analytical logbook. This documentation references the Standard ID of the respective parent solution(s) used in its preparation, providing a solid trail back to the solution or chemical received from the vendor. These records include the standard name, final volume, matrix, final concentration, analyst initials, prep date and expiration date. A daughter solution should not have an expiration date which post-dates any of the parent solutions used in its preparation.

References standards are labeled with a unique Standard Identification Number, date received, and the expiration date. All documentation received with the reference standard or documentation of standard purity is retained as a QC record and references the Standard Identification Number. All efforts are made to purchase standards that are $\geq$ 97.0% purity. If this is not possible, the purity is used in performing standards calculations.

The accuracy of calibration standards is checked by comparison with a standard from a second source. In cases where a second standard manufacturer is not available, a different lot is acceptable for use as a second source. The appropriate QC criteria for specific standards are defined in laboratory SOPs. In most cases, the analysis of an ICV or LCS is used as the second source confirmation.

Storage conditions, such as shelf life, ambient or chilled, controlled or restricted access, wet or desiccated, etc., are in conformance with the specifications set in the associated method, the program requirements, or the manufacturer's recommendation, as appropriate.

5.5.3 Reagents

Reagents are, in general, required to be analytical reagent grade unless otherwise specified in method SOPs. Reagents must be, at a minimum, the purity required in the test method. The date of reagent receipt, date the reagent was opened, and the date of reagent preparation (where applicable) are documented (Dry Chemical/Solvent/Wet Chemical Receipt Logbook, PHX-SM-009; and Chemical Login Label, PHX-SM-008).

5.6 Sampling

Sample representativeness and integrity are the foundations upon which meaningful analytical results rely. Where documented and approved SAPs and/or QAPPs are in place, they must be made available to the laboratory before sample receipt, and approved by laboratory management before sample receipt.

5.7 Sample Handling, Transport, and Storage

5.7.1 General

COC can be established either when bottles are sent to the field, or at the time of sampling. AEL can provide all of the necessary coolers, reagent water, sample containers, preservatives, sample labels, custody seals, COC forms, ice, and packing materials required to properly preserve, pack, and ship samples to the laboratory. Complete details for sample container preparation are contained within the latest revision of SOP 11-007 Bottle Order Preparation. A summary of sample receipt is as follows with complete details available within the Sample Receipt and Login SOP (11-001).

Samples are received at the laboratory by the designated sample custodians and a unique LIMS work order number is assigned. The following information is recorded for each sample shipment:

- Client/Project Name.
- Date and Time of Laboratory Receipt.
- Laboratory Work Order Number.
- Signature or initials of the personnel receiving the cooler and making the entries.

Upon inspection of the cooler and custody seals, the sample custodian opens and inspects the contents of the cooler, and records the cooler temperature. If the cooler arrival temperature is outside the required or method specified temperature range of 0 - 6^{o}C; sample receipt is considered “compromised” and the procedure described in Section 4.7.1 is followed. All documents are immediately inspected to assure agreement between the test samples received and the COC.

Any non-conformance, irregularity, or compromised sample receipt as described in Section 4.7.1 is documented on the Sample Receipt Checklist (PHX-SM-002) or COC; and brought to the immediate attention of the Project Manager for resolution with the client. The COC, shipping documents, documentation of any non-conformance, irregularity, or compromised sample receipt, record of client contact, and resulting instructions become part of the permanent project record.

Samples that are being tested at another TestAmerica-STL facility or by an external subcontractor are repackaged, iced, and sent out under COC.

Following sample labeling as described in Section 5.7.2, the sample is placed in storage. Refrigerated storage coolers are maintained at 4 $\pm$ 2^{o}C. The temperature is monitored daily. All samples are stored according to the requirements outlined in the test method, and in a manner such that they are not subject to cross contamination or contamination from their environment.

Access to the laboratory is restricted to laboratory personnel or escorted guests as described in Section 5.2. Therefore, once sample possession is relinquished to the laboratory, the sample is in a designated secure area (e.g., the laboratory facility) accessible only to authorized personnel.

5.7.2 Sample Identification and Traceability

The sample receiving personnel organize the sample containers, COCs, and all pertinent information associated with the samples. The sample identity is verified against all associated sample information. Any inconsistencies are documented via the Sample Receipt Checklist and forwarded to the Project Manager for resolution with the client prior to identifying the sample(s) into LIMS.

Each sample container is assigned a unique Sample Identification Number that is cross-referenced to the client identification number such that traceability of test samples is unambiguous and documented. Each sample container is affixed with a durable sample identification label.

All unused portions of samples, including empty sample containers, are returned to the secure sample control area, unless it has been documented that the container was disposed.

5.7.3 Sub-Sampling

Taking a representative sub-sample from a container containing a soil or solid matrix is necessary to ensure that the analytical results are representative of the sample collected in the field. The size of the sample container, the quantity of sample fitted within the container, and the homogeneity of the sample need consideration when sub-sampling for sample preparation.

Any non-homogenous looking material is avoided and noted as such within the sample preparation record.

5.7.4 Sample Preparation

Sample preparation procedures vary for each matrix and analytical method are as referenced in the laboratory SOPs.

5.7.5 Sample Disposal

Samples are retained in AEL storage facilities for 30 days after the project report is sent unless prior written arrangements have been made with the client. Samples may be held longer or returned to the client per written request. Unused portions of samples are disposed of in accordance with federal, state and local regulations. The laboratory removes or defaces sample labels prior to disposal unless this is accomplished through the disposal method (e.g., samples are incinerated). Complete details on the disposal of samples, digestates, and extracts is available within the Sample Disposal and Waste Management SOP (11-002), and the Microbiological Sample Disposal SOP (11-003).

5.8 Assuring the Quality of Test Results

5.8.1 Proficiency Testing

The laboratory analyzes Proficiency Test (PT) samples as required for accreditation according to the following schedule:

Table 11. Performance Testing Study Participation

Performance Testing Study	Analyses Performed	Frequency
Water Supply Study as required by the EPA under the Safe Drinking Water Act	All licensable parameters for which a proficiency evaluation sample is available	Annually
Water Pollution Study as required by the EPA under the Clean Water Act	All licensable parameters for which a proficiency evaluation sample is available	Annually
DMRQA PT Study	Trace Metals, Inorganics	Annually*
Soil PT Study	Trace Metals, Inorganics, Organics	Annually
NELAC Accreditation	All licensable parameters for which a proficiency evaluation sample is available	Two times per year**
AIHA IHPAT Study	Metals, Formaldehyde, Volatile Solvents Passive Monitors	Quarterly Semi-annually

* At a client's request

** NELAC – Two times per year, per analyte, per matrix, per program

The laboratory also participates in various client PT programs, when submitted.

PT samples are handled and tested in the same manner (procedural, equipment, staff) as client samples. Results of PT samples are distributed to the laboratory line management for review and action, if required. Any required response to deficiencies are submitted to the QA department for review and are filed with the PT study records. PT test sample data is archived using the requirements for project and raw data record retention.

5.8.1.1 Double Blind Performance Evaluation

The laboratory can also participate in an annual double blind performance evaluation study. An external vendor is contracted to submit double blind samples to the laboratory. Both the level of customer service and the accuracy of the test results are assessed objectively by the external contractor, who provides a detailed report to the Corporate Quality Director and to the laboratory. This is administered as a double blind program in order to assess all facets of the laboratory's operations.

5.8.2 Control Samples

Control samples (e.g., QC indicators) are analyzed with each batch of samples to monitor laboratory performance in terms of accuracy, precision, sensitivity, selectivity, and interferences. Control samples must be uniquely identified and correlated to unique batches. Control samples further evaluate data based upon (1) Method Performance, which entails both the preparation and measurement steps; and (2) Matrix Effects, which evaluates field sampling accuracy, precision, representativeness, interferences, and the effect of the matrix on the method performed. Each regulatory program and each method within those programs specify the control samples that are prepared and/or analyzed with a specific batch.

Control sample types and typical frequency of their application are outlined Sections 5.8.2.1 through 5.8.2.5 and Tables 12 through 16. Note that frequency of control samples vary with specific regulatory, methodology and project specific criteria. Complete details on method and regulatory program control samples are as listed in each method SOP.

5.8.2.1 Method Performance Control Samples: Preparation Batch

Sample preparation or pre-treatment is commonly required before analysis. Typical preparation steps include homogenization, grinding, solvent extraction, sonication, acid digestion, distillation, reflux, evaporation, drying and ashing. During these pre-treatment steps, samples are arranged into discreet manageable groups referred to as preparation (prep) batches. Prep batches provide a means to control variability in sample treatment.

Control samples are added to each prep batch to monitor method performance (Table 12) and are processed through the entire analytical procedure with investigative/field samples.

Table 12. Preparation Batch Control Samples

Control Type	Details	
Method Blank (MB)	Use	Monitors for potential contamination introduced during the sample preparation and analytical processes.
	Typical Frequency [1]	1 per batch of $\leq$ 20 samples per matrix type per sample extraction or preparation method.

Table 12. Preparation Batch Control Samples

Control Type	Details	
	Description	Organics: Laboratory pure water for water samples or a purified solid matrix for soil or solid samples (when available or when requested); solid matrices commonly include sodium sulfate, vendor or agency supplied soil or solid, or purchased sand; these solids may require purification at the laboratory prior to use. Inorganics: Laboratory pure water for both water and soil or sediment samples. Volume/weights are selected to approximately equal the typical sample volume/weight used in sample preparation; and final results in a soil/solid batch may be calculated as mg/kg or ug/kg, assuming 100% solids and a weight equivalent to the aliquot used for the corresponding field samples, to facilitate comparison to actual field samples.
Laboratory Control Sample (LCS)	Use	Measures the accuracy of the method in a blank matrix and assesses method performance independent of potential field sample matrix affects.
	Typical Frequency [1]	1 per batch of ≤ 20 samples per matrix type per sample extraction or preparation method. For multi-analyte methods, the LCS may consist of surrogates in the blank matrix, and or a representative selection of target analytes/internal standards.
	Description	Prepared from a reference source of known concentration and processed through the preparation and analysis steps concurrently with the field samples. Aqueous LCS's may be processed for solid matrices unless a solid LCS is requested; final results may be calculated as mg/kg or ug/kg, assuming 100% solids and a weight equivalent to the aliquot used for the corresponding field samples, to facilitate comparison with the field samples.
Known QC Sample	Use	Comply with regulatory requirements; check the accuracy of an analytical procedure; troubleshoot method performance problems; verify an analyst in training's ability to accurately perform a method; to verify the return-to-control after method performance problems; and may also be used as an LCS.
	Typical Frequency [1]	As defined by the client or QAPP.
	Description	Obtained from outside suppliers or agencies; generally require preparation from concentrated materials by dilution into a standard matrix; contain known analytes or compounds; acceptance limits are provided by the vendor.

[1] Denotes a TestAmerica-STL required frequency.

Field blanks, equipment blank and trip blanks, when received, are analyzed in the same manner as other field samples. However, a field blank should not be selected for matrix QC, as it does not provide information on the behavior of the target compounds in the field samples. Usually, the client sample ID will provide information to identify the field blanks with labels such as "FB", "EB", or "TB".

5.8.2.2 Method Performance Control Samples: Matrix

Matrix control samples include sample duplicates (MD), sample matrix spikes (MS), and sample surrogate spikes. These control samples help monitor for potential physical and chemical effects which may interfere with the precision and/or accuracy of the selected analytical method. Since interferences can enhance or mask the presence of target analytes, matrix control samples measure the degree of interference and are used to assist in the interpretation of the analytical results. The laboratory avoids performing matrix QC on known field blank samples, such as trip blanks and rinsates, since these samples are not indicative of the sample matrix.

Table 13. Matrix Control Samples

Control Type	Details	
Matrix Duplicate (MD)	Use	Monitors the effect of site matrix on the precision of the method; and of the reproducibility of laboratory preparation and measurement techniques. **Note:** Precision may also be affected by the degree of homogeneity of the sample, particularly in the case of non-aqueous samples or aqueous samples with particulates. Sample homogeneity and matrix effect should be considered when field samples are used to assess reproducibility. **Note:** A field duplicate, when received, measures Representativeness of sampling and the effect of the site matrix upon precision.
	Typical Frequency [1]	1 per 20 samples per matrix or per SAP/QAPP [2].
	Description	Performed by analyzing two aliquots of the same field sample independently; analyzed for each associated sample matrix (e.g., when requested by the client or the analytical method).
Matrix Spike (MS)	Use	Measures the effect of site sample matrix on the accuracy of the method.
	Typical Frequency [1]	1 per 20 samples per matrix or per SAP/QAPP.
	Description	Aliquot of a field sample, which is spiked with the analytes or compounds of interest; analyzed for each associated sample matrix (when requested by the client or analytical method). The determination of MS percent recovery (% R) requires an analysis of a fortified sample and a non-fortified sample under the same procedural conditions (e.g., sample volumes, dilutions, procedural conditions, etc.). The concentration determined in the non-fortified sample is subtracted from the fortified sample concentration before determining the %R. The degree of homogeneity of the sample, particularly in the case on non-aqueous samples or samples with particulates, may affect the ability to obtain representative recoveries.
Matrix Spike Duplicate (MSD)	Use	Measures effect of site sample matrix on precision of method.
	Typical Frequency [1]	1 per 20 samples per matrix, when requested by the client or the analytical method, or per SAP/QAPP [2].
	Description	Alternative to sample duplicate. Generally, inorganic protocols specify an MD/MS and organic protocols specify an MS/MSD.
Surrogate Spike	Use	Measures method performance to sample matrix (organics only).
	Typical Frequency [1]	Every QC and analytical sample.
	Description	Compounds similar to the target analytes in structure, composition and chromatography, but not typically found in the environment, are added to each QC and analytical sample, prior to preparation (e.g., extraction). If the surrogates in an analytical batch do not all conform to established control limits, the pattern of conformance in investigative and control samples is examined to determine the presence of matrix interference or the need for corrective action.
Internal Standards	Use	Monitor the qualitative aspect of organic and inorganic analytical measurements.
	Typical Frequency [1]	All organic and ICP methods as required by the analytical method.
	Description	Used to correct for matrix effects and to help troubleshoot variability in analytical response and are assessed after data acquisition. Possible sources of poor internal standard response are sample matrix, poor analytical technique or instrument performance.

[1] Denotes a TestAmerica-STL required frequency.
[2] Either an MSD or an MD is required per 20 samples per matrix or per SAP/QAPP.

5.8.2.3 Matrix QC Frequencies

The frequency of matrix QC indicators depends on regulatory program compliance, a project's data quality objectives, or a client's requirements. The following frequency will be applied to samples when the regulatory programs are known and it does not conflict with project or client requirements.

Table 14. EPA Program Requirements

Program	Description [1]
SDWA	MD performed at a 10% frequency or 1 per preparation batch of ≤10 samples, whichever is more frequent.
CWA	MS (GC methods) and MD is performed at a 10% frequency or 1 per preparation batch of ≤10 samples, whichever is more frequent. For GC/MS Methods, MS is performed at a 5% frequency or 1 per preparation batch of ≤20 samples, whichever is more frequent.
RCRA	MS/MSD or MS/MD is performed at a rate of 5% per client (independent of the preparation batch). For clients submitting less than 10 samples, the method matrix QC requirement may be satisfied by another clients sample within the same prep batch unless the paperwork indicates a client requirement for matrix QC. Matrix QC will only be reported to the client who owns the data.
U.S. EPA CLP	MS/MSD or MS/MD is performed at a rate of 5% or 1 set per Sample Delivery Group (SDG) per matrix, independent of the prep batch.

[1] MS, MSD and MD may not be applicable to some analytical protocols because of the nature of the sample or protocol.

5.8.2.4 Method Performance Control Samples: Instrument Measurement

Control samples are used to ensure that optimum instrument performance is achieved. These samples help ensure that the proper identification and quantitation of target compounds or analytes are achieved. The instrument control samples appropriate to each analytical technique are described in laboratory SOPs for each respective method. A brief description of these checks is included in Table 15.

Table 15. Instrument Performance Control Samples

Control Type	Description	
Inorganics		
ICV	Use	Calibration standard of known concentration prepared from a source other than that used for the calibration standards.
	Sequence	Analyzed after the standard curve to confirm calibration.
ICB	Use	Blank water or solvent; confirms the calibration and ensures that any potential contamination is less than the reporting limit.
	Sequence	Analyzed immediately after the ICV.
ICP Interference Check Samples (ICSA/ICSB)	Use	Verifies the absence of spectral interferences.
	Sequence	Analyzed consecutively at the beginning of each eight-hour analytical sequence, after the ICV/ICB, and again at an eight hour frequency following a CCV/CCB. When CLP protocols are followed, the ICSA/B will be analyzed with the analytical sequence, before the final CCV/CCB.
Reporting Limit Verification Standard (CRA & CRI)	Use	Verifies linearity near the reporting limit for CLP metals analyses. (Note: CRI is at a level 2X the CRDL; CRA is near the CRDL).
	Sequence	Analyzed after the ICB. The CRI is also analyzed at the end of the eight hour analytical sequence, prior to analysis of the final CCV/CCB.

Table 15. Instrument Performance Control Samples

Control Type	Description	
CCV	Use	Confirm that the instrument performance has not significantly changed during the analytical sequence; to verify stable calibration throughout the sequence; and/or to demonstrate that instrument response did not drift over a period of non-use. Made from a source other than that used for the standard curve.
	Sequence	Analyzed at 10% or every two hours, whichever is more frequent; also analyzed at the end of the analytical sequence.
CCB	Use	Water blank used to confirm that the baseline has not drifted and to monitor for contamination at the reporting limit.
	Sequence	Analyzed at a rate of 10% for inorganics and at a rate of 1 per 10 readings/injections or every two hours, whichever is more frequent, for CLP metals; also analyzed at the end of the analytical sequence.
ICP Metals Linear Range	Use	Verify linearity and document the upper limit of the calibration range for each element.
Analysis Standard (LRS)	Sequence	Performed quarterly with a blank and a minimum of five standard concentrations to cover the anticipated range of measurement; one of the calibration standards will be at or near the reporting limit. The calibration curve generated must have a correlation coefficient $\geq$ 0.995 in order to consider the responses linear over that range.
ICP Inter-Element Correction (IEC)	Use	Correction factors for spectral interference (particularly due to Al, Ca, Fe, and Mg).
	Sequence	Determined at least annually for all wavelengths used for each analyte reported by ICP; or any time the ICP is adjusted in any way that may affect the IECs.
Organics		
GC/MS Tuning & Performance	Use	Ensures correct mass assignment and is monitored through response to target compounds during initial and continuing calibration, with minimum response criteria for specified system performance check compounds (SPCCs), and linearity is verified by evaluating the response factors (RF) for calibration check compounds (CCCs).
	Sequence	Tuned at the beginning of the daily work shift. Throughout the analysis, blanks, internal standard areas, surrogates, chromatographic baseline, resolution of peaks, and overall quality of the chromatography are used collectively to monitor instrument performance.
GC & HPLC Instrument Performance	Use	Monitored through retention time shift evaluation, linearity checks, and degradation checks of selected target compounds (e.g., for Endrin or DDT as appropriate).
	Sequence	Continuing calibration verification (e.g., blanks, shifts in chromatographic baseline or retention times, resolution of peaks, and overall quality of the chromatography) throughout the analytical sequence is accomplished through analysis of calibration check standards.

5.8.2.5 Method Performance Control Samples: Analysis Batch

Matrix specific control samples are used to assess the precision and accuracy of the method as applied to the specific sample matrix. These indicators provide information on sample matrix effects that is independent of the efficiency of the preparatory technique. The method performance control samples appropriate to each analytical technique are identified in the respective method. A brief description of these checks is included in Table 16.

These control samples are performed to provide a tool for evaluating how well the method performed for the respective matrix. These values are used by the client to assess the validity of a reported result within the context of the project's data quality objectives. For matrix specific QC results falling outside laboratory control limits which are attributed to matrix affects, no systematic corrective action is taken.

Table 16. Analysis Batch Performance Control Samples

Control Sample Type	Description	
ICP Serial Dilution	Use	5X Dilution of a field sample (performed at the instrument) to check for possible physical and/or chemical interferences.
	Sequence	5% of field samples or 1 per ≤20 samples per batch.
CVAA Analytical Bench Spike	Use	Required by the method; prepared at the instrument by fortifying the digestate with a known quantity of the analyte of interest.
	Sequence	Performed on each sample immediately following the unspiked original analysis.
Method of Standard Addition (MSA)	Use	When specified by the analytical protocol or by client request.
	Sequence	When specified by the analytical protocol or by client request.

5.8.3 Statistical Control Limits and Charts

Statistical control limits and control charts are used to establish method performance of a given analysis and to monitor trends of QC results graphically over time. Once a database of the laboratory results for a method/matrix/QC analyte combination is established, the acceptability of a given analysis of that QC parameter (and of the analytical batch to which it belongs) can be evaluated in light of the laboratory's normal performance. This is intended to help identify problems before they might affect data. Often, patterns of response that are not at all evident in sets of numbers are very distinct when the same values are viewed as a chronological graph.

Establishment of Limits

The purpose of using statistical control limits is to define, for each analyte in a given method/matrix/QC type combination, a range of expected values. This range encompasses the random variation that occurs normally in the laboratory and allows one to evaluate control samples in that context, rather than according to an arbitrary or external set of values. Limits for accuracy and precision are defined below:

Accuracy

As recoveries of a QC analyte in a given matrix are tabulated over time, a mean value for recovery is established, as is the standard deviation (s) of those recoveries. If the analysis is in statistical control (e.g., if the set of QC recoveries over time show random variation about the mean) approximately 99.7% of all recoveries for that QC will fall within three standard deviations (3s) of the mean. Thus, assuming that the mean itself is an acceptable level of recovery, the values corresponding to 3s above and 3s below the mean are defined as the Control Limits.

Any single recovery outside these values is assumed to have resulted from some circumstance other than normal variation and shall be investigated.

Roughly 95% of points should fall within 2s of the mean. The values +2s and -2s are the Warning Limits. Any normal result has approximately a 1/20 chance of being between 2s and 3s from the mean, so a result in this region doesn't necessarily warrant corrective action, but attention should be paid to such points.

Precision

Precision is used to indicate matrix variability so that appropriate decisions can be made by the client when repeated analyses vary significantly. The coefficient of variation, expressed as a percentage (e.g., the %RSD) for the data set used to calculate accuracy control limits defines the control limit for precision. Duplicate analyses of the QC samples, such as duplicates or MS/MSD, should have an RPD less than or equal to this established precision control limit to be considered free of matrix interferences.

The laboratory calculates statistical control limits on a semi-annual basis, or more frequently if change have been made to the analytical process which affects the chemistry of the method. Such limits are available on a project or QAPP-specific basis.

5.8.4 Calibration

Calibration protocols are method-specific, are briefly described in Table 10 and are defined in the method SOPs.

5.8.5 Glassware Cleaning

All glassware is thoroughly cleaned prior to use to ensure that sample integrity is not affected from artifacts caused by contaminated glassware.

A summary of general cleaning procedures follows with details provided in the Glassware Washing SOP 09-004:

General laboratory glassware is cleaned with a low- or non-phosphate detergent, followed by thorough rinsing with tap water and deionized water.

Volumetric flasks and pipettes used for inorganics (method dependent), test tubes and caps used for micro-COD procedures, phosphate glassware, and metals-related glassware include an acid-washing step.

BOD glassware, includes use of EPA approved disposable plastic bottles or cleaning with a nitric or sulfuric acid and/or a NOCHROMIX-washing step.

Organic glassware includes a solvent-wash.

Non-volumetric organic glassware may optionally be kiln dried at 400°C.

5.8.6 Permitting Departures from Documented Procedure

Where a departure from a documented SOP, test method, or policy is determined to be necessary, or unavoidable, the departure is documented in a CAR, on the Data Review Checklist or in the logbook and reported in the case narrative. In most cases, these departures can be made with the approval of the Department Supervisor, Project Manager and the client. Issues of serious concern, as determined by the Department Supervisor or Project Manager, will be brought to the attention of the Laboratory Director and/or QA Manager. In some instances, it is appropriate to inform the client before permitting a departure. The Project Manager, in consultation with the QA Manager, will make the determination as to the degree of notification required by the client.

On rare occasions, special analytical techniques will be requested for research, project specific requirements, or client needs. In these instances, SOPs may not be available, however, the analyst will thoroughly record the analytical steps and observations within a bound preformatted logbook or on a Data Review Checklist.

5.8.7 Development of QC Criteria, Non-Specified in Method/Regulation

Where a method or regulation does not specify acceptance and/or rejection criteria, the laboratory must examine the data user's needs and the demonstrated sensitivity, accuracy and precision of the available test methods in determining appropriate QC criteria.

Data users often need the laboratory's best possible sensitivity, accuracy, and precision using a routinely offered test method, or are unsure of their objectives for the data. For routine test methods that are offered as part of AEL's standard services, the laboratory bases the QC criteria on statistical information such as determination of sensitivity, historical accuracy and precision data, and method verification data. The method SOP includes QC criteria for ongoing demonstration that the established criteria are met (e.g., acceptable LCS accuracy ranges, precision requirements, method blank requirements, initial and continuing calibration criteria, etc.).

In some cases, a routine test method may be far more stringent than a specific data user's needs for a project. The laboratory may either use the routinely offered test method, or may opt to develop an alternate test method based on the data user's objectives for sensitivity, accuracy, and precision. In this case, it can be appropriate to base the QC criteria on the data user's objectives, and demonstrate through method verification and ongoing QC samples that these objectives are met.

For example, a client may require that the laboratory to test for a single analyte with specific DQOs for sensitivity, accuracy, and precision as follows: Reporting Limit of 10 ppm, Accuracy $\pm$25%, and RSD of <30%. The laboratory may opt to develop a method that meets these criteria and document through the Method Blank results, MDL study, and LCS results that the method satisfies those objectives. In this case, both the method and the embedded QC criteria have been based on the client's DQOs.

In some cases, the data user needs more stringent sensitivity, accuracy, and/or precision than the laboratory can provide using a routine test method. In this case, it is appropriate that the laboratory provide documentation of the sensitivity, accuracy, and precision obtainable to the data user and let the data user determine whether to use the best available method offered by the laboratory, or determine whether method development or further research is required.

5.9 Project Reports

Analytical reports comprise final results (uncorrected for blanks and recoveries unless specified), methods of analysis, levels of reporting, surrogate recovery data, and method blank data. In addition, special analytical problems will be noted in the case narratives. The number of significant figures reported are consistent with the limits of uncertainty inherent in the analytical method. Consequently, most analytical results will be reported to no more than two (2) or three (3) significant figures. Data are normally reported in units commonly used for the analyses performed.

Concentrations in liquids are expressed in terms of weight per unit volume (e.g., milligrams per liter, mg/L). Concentrations in solid or semi-solid matrices are expressed in terms of weight per unit weight of sample (e.g., micrograms per kilograms, μg/kg). Reporting limits take into account all appropriate concentration, dilution, and/or extraction factors, unless otherwise specified by program requirements.

A client report is generated with various steps of approval prior to printing of the final version. If any analytical anomalies were encountered during the analyses, e.g., an out-of-control matrix duplicate, it is documented in a case narrative. The case narrative is prepared by the Project Manager, or other designated personnel and inserted in the final report.

The final report forms are printed, data packages are organized, a glossary of flags and acronyms is added, and reports are paginated.

5.9.1 General

The criteria described in Section 5.9.2 apply to all Project Reports that are generated under NELAC and AHIA requirements. The criteria described in Section 5.9.3 and 5.9.4 apply to all Project Reports.

5.9.2 Project Report Content

- Title
- Laboratory Name, Address, Telephone Number, Contact Person
- Unique Laboratory Work Order Number
- Total Number of Pages (report must be paginated)
- Name and Address of Client
- Client Project Name (if applicable)
- Laboratory Sample Identification
- Client Sample Identification
- Matrix and/or Description of Sample
- Dates: Sample Receipt, Collection, Preparation and/or Analysis Date
- Definition of Data Qualifiers
- Reporting Units
- Test Method

The following are required where applicable to the specific test method or matrix:

- Solid Samples: Indicate Dry or Wet Weight
- If holding time < 72 hours, Sample Collection, Preparation and/or Analysis Time
- Indication by flagging where results are reported below the quantitation limit.

5.9.3 Project Narrative

A Project Narrative and/or Cover Letter is included with each project report and, at a minimum, includes an explanation of any and all of the following occurrences:

- Listing of any subcontracted analyses and subcontractor location
- Non-conformances
- Method Deviations
- QC criteria failures

If the samples were “compromised” at time of receipt (see Section 4.7.1), this is noted in the Sample Receipt Checklist. The Sample Receipt Checklist is part of the final report.

Project Release

The Project Manager or his designee authorizes the release of the project report with a signature.

Where amendments to project reports are required after issue, these are documented in the project folder and can be in the form of a separate document and/or electronic data deliverable resubmittal. The amended report is clearly identified as amended with the details of what was amended. Any amended data goes through the same approval/review process by the respective Department Supervisor/designee as occurred with the initial data. The Project Manager reviews and signs the amended report. The original version of the project report is kept intact and the revisions and cover letter included in the project files.

5.9.4 Subcontractor Test Results

Subcontracted data is clearly identified as such, and the name, address, and telephone number for the laboratory performing the test is included in the project report. Subcontracted results from laboratories external to AEL are not reported on AEL report forms or AEL letterhead. Test results from more than one TestAmerica-STL facility are clearly identified with the name of the TestAmerica-STL facility that performed the testing, address, and telephone number for that facility. Data from subcontractors' reports may be added to an AEL electronic deliverable.

Data subcontracted within TestAmerica-STL may be reported on the originating laboratory's report forms provided the following mandatory requirements are met:

- The name, address, and telephone number of the facility are provided.
- Analytical results produced by the TestAmerica-STL intra-company subcontractor are clearly identified as being produced by the subcontractor facility.
- The intra-company subcontractor's original report, including the chain of custody is retained by the originating laboratory.
- Proof of certification is retained by the originating laboratory.
- All information as outlined in Section 5.9.2 is included in the final report where the report is required to be compliant with NELAC, for both the originating and subcontracting laboratory.

5.9.5 Electronic Data Deliverables

Electronic Data Deliverables (EDD) are routinely offered as part of AEL's services. AEL offers a variety of EDD formats. EDD specifications are submitted to the IT department by the PM for review and undergo the contract review process in Section 4.4.1. Once the laboratory has committed to providing data in a specific format, the coding of the format may need to be performed. This coding is documented and validated. The validation of the code is retained as a laboratory record.

EDDs are subject to a review to ensure their accuracy and completeness. If EDD generation is automated, review may be reduced to periodic screening if the laboratory demonstrates that it can routinely generate that EDD without errors. Any revisions to the EDD format are reviewed until it is demonstrated that it can routinely be generated without errors.

5.9.6 Project Report Format

AEL offers a wide range of project reporting formats, including EDDs, short report formats, and complete data deliverable packages modeled on the Contract Laboratory Protocol (CLP) guidelines. More information on the

range of project reports is available from the Project Manager. Regardless of the level of reporting, all projects undergo the levels of review as described in Section 5.3.6.

5.9.7 Arizona Data Qualifiers – Revision 2.0 (11/26/2003)

The following is the list of approved data qualifiers for use in qualifying Arizona environmental compliance data.

A1 = Too numerous to count (microbiology).
A2 = Sample incubation period exceeded method requirement (microbiology).
A3 = Sample incubation period was shorter than method requirement (microbiology).
A4 = Target organism detected in associated method blank (microbiology).
A5 = Incubator/water bath temperature was outside method requirements (microbiology).
A6 = Target organism not detected in associated positive control (microbiology).
A7 = Micro sample received without adequate headspace.
B1 = Target analyte detected in method blank at or above the method reporting limit
B2 = Non-target analyte detected in method blank and sample, producing interference.
B3 = Target analyte detected in calibration blank at or above the method reporting limit.
B4 = Target analyte detected in blank at/above method acceptance criteria.
B5 = Target analyte detected in method blank at or above the method reporting limit, but below trigger level or MCL.
B6 = Target analyte detected in calibration blank at or above the method reporting limit, but below trigger level or MCL.
B7 = Target analyte detected in method blank at or above method reporting limit. Concentration found in the sample was 10 times above the concentration found in the method blank.
C1 = Confirmatory analysis not performed as required by the method.
C2 = Confirmatory analysis not performed. Confirmation of analyte presence established by site historical data.
C3 = Qualitative confirmation performed. See case narrative.
C4 = Confirmatory analysis was past holding time.
C5 = Confirmatory analysis was past holding time. Original result not confirmed.
D1 = Sample required dilution due to matrix interference. See case narrative.
D2 = Sample required dilution due to high concentration of target analyte.
D3 = Sample dilution required due to insufficient sample.
D4 = Minimum reporting level (MRL) adjusted to reflect sample amount received and analyzed.
E1 = Concentration estimated. Analyte exceeded calibration range. Reanalysis not possible due to insufficient sample.
E2 = Concentration estimated. Analyte exceeded calibration range. Reanalysis not performed due to sample matrix.
E3 = Concentration estimated. Analyte exceeded calibration range. Reanalysis not performed due to holding time requirements.
E4 = Concentration estimated. Analyte was detected below laboratory minimum reporting level (MRL).
E5 = Concentration estimated. Analyte was detected below laboratory minimum reporting level (MRL), but not confirmed by alternate analysis.
E6 = Concentration estimated. Internal standard recoveries did not meet method acceptance criteria.
E7 = Concentration estimated. Internal standard recoveries did not meet laboratory acceptance criteria.
H1 = Sample analysis performed past holding time. See case narrative.
H2 = Initial analysis within holding time. Reanalysis for the required dilution was past holding time.
H3 = Sample was received and analyzed past holding time.
H4 = Sample was extracted past required extraction holding time, but analyzed within analysis holding time. See case narrative.

Appendix 1. List of Cited SOPs and Work Instructions

Cited Section No(s).	Description	Document No.
1.6 5.7.1	Container Management	SOP 11-001
4.1	Signature Authority	Part B – AZ Department of Health Services Application
4.1.1	AEL Master Equipment List	PHX-QA-049
4.1.2	Computer System Account and Naming Policy Computer System Password Policy Software Licensing Policy Virus Protection Policy	P-I-003 P-I-004 P-I-005 P-I-006
4.3.1	Document Control	AQUA Database PHX-QA-001
4.3.1.1 5.3.2	Approved SOP Master Listing	AQUA Database PHX-QA-051
4.3.2 4.12.3	Record Retention & Purging	SOP 09-017
4.5	Subcontracting	S-L-001
4.6	Procurement Quality Assurance Process	P-Pu-001 SOP 09-038
4.6.1	Testing Solvents and Acids	S-T-001
4.7.2	Client Confidentiality	P-L-006
4.8, 4.11	Non-conformance Report (NCM)	SOP 09-037
4.8, 4.11	Quality Systems Management Review	PHX-QA-050
4.11	Preventive Action Measures	PHX-QA-050
4.13	Systems Audits	S-Q-002
5.1.3	Ethics Policy	P-L-006
5.3.1	Methods Capabilities	PHX-QA-011
5.3.2	SOP Change Protocol	PHX-QA-006
5.3.5	MDL Policy	S-Q-003 SOP 09-010
5.3.6.1	Acceptable Manual Integration Practices	S-Q-004 SOP 09-023
5.3.6.2	Data Review Checklists	Refer to the analytical SOP
5.4.1	Master Equipment List	PHX-QA-049
5.4.2	Instrument and Equipment Out-of-Service Tagging	PHX-QA-049
5.4.3	Selection of Calibration Points	P-T-001 SOP 09-029
5.5.1	Balance Calibration, Care and Use	PHX-QA-008
5.5.1	Thermometer Calibrations	SOP 09-034 PHX-QA-008, PHX-QA-025
5.5.1	Water Quality	PHX-CH-035 PHX-MC-001
5.7.1	Sample Receipt Process	SOP 11-001 PHX-SM-002, PHX-SM-015
5.7.5	Laboratory Waste Disposal Procedures	SOP 11-002 SOP 11-003
5.8.5	Glassware Cleaning Procedures	SOP 09-004
5.9 5.9.6	Data Reporting	SOP 09-008

Appendix 2. Environmental Containers, Preservative and Holding Times

Drinking Water

Method	Parameter	Amount	Container	Preservative	Hold Time	
					Prep.	Analysis
2310 2320	Alkalinity, Acidity	100 mL	1-1L P	2-6ºC	N/A	14 days
TEM	Asbestos	1000 mL	1-1L P	2-6ºC	N/A	48 hours
300.0	Chloride, Sulfate, Bromide	500 mL	1-1L P	2-6ºC	N/A	28 days
300.0	Nitrate (Chlorinated)	100 mL	1-500 mL P	2-6ºC - non-acidified	N/A	14 days
300.0	Nitrate (non-chlorinated)	100 mL	1-500 mL P	2-6ºC - non-acidified	N/A	48 hours
300.0 4500	Nitrite	100 mL	1-500 mL P	2-6ºC	N/A	48 hours
300	Nitrate + nitrite	100 mL	1-500 mL P	2-6ºC, H_2SO_4, pH <2	N/A	28 days
4500	Cyanide	500 mL	1-500 mL P	2-6ºC, ascorbic acid (if chlorinated), NaOH, pH>12	N/A	14 days
300.0 4500	Fluoride	300 mL	1-1L P	2-6ºC	N/A	28 days
200.x	Lead and Copper	1000 mL	1-1L P	None, preserved at laboratory with HNO_3, pH<2	N/A	6 months
2510	Conductivity	100 mL	1-1L P	2-6ºC	N/A	28 days
2330B	Corrosivity (pH)	500 mL	1-1L P	None	N/A	Immediately
314.0	Perchlorate	100 mL	1-500 mL P	None	N/A	28 days
2540	Total Dissolved Solids	100 mL	1-1L P	2-6ºC	N/A	7 days
180.1	Turbidity	100 mL	1-1L P	2-6ºC	N/A	48 hours
9215 B SimPlate	Heterotrophic Plate Count	100 mL	2-120 mL P (sterile)	<10°C, Sterile, $Na_2S_2O_3$	N/A	8 hours
9215 (if analysis cannot begin within 8 hours)	Heterotrophic Plate Count	100 mL	2-120 mL P (sterile)	2-6ºC, Sterile, Na2S2O3	N/A	Must not exceed 24 hours

Drinking Water – cont'd

Method	Parameter	Amount	Container	Preservative	Hold Time	
					Prep.	Analysis
9221 B & C	Total and Fecal Coliforms by MPN	100 mL	2-120 mL P (sterile)	<10°C, Sterile, Na2S2O3	N/A	30 hours
9221E, 9222D	Fecal Coliforms	100 mL	2-120 mL P (sterile)	<10°C, Sterile, Na2S2O3	N/A	30 hours
9223 B	Total Coliforms and *E. Coli* by Colilert	100 mL	2-120 mL P (sterile)	<10°C, Sterile, Na2S2O3	N/A	30 hours
504.1	EDB/DBCP	80 mL	2-40 mL G vials	2-6°C, Na2S2O3	14 days	24 hours (after extraction)
505	Pesticides and PCBs	80 mL	2-40 mL G vials	2-6°C, Na2S2O3	14 days, 7 days for Heptachlor)	24 hours (after extraction)
508	Pesticides	2000 mL	1Gallon amber G	2-6°C, Na2S2O3, Dark	7 days (see method for exceptions)	14 days (after extraction)
508.1	Pesticides	2000 mL	1Gallon amber G	2-6°C, Na2S2O3, HCl pH<2	14 days (see method for exceptions)	30 days (after extraction)
515.1	Herbicides	80 mL	2-40 mL amber G vials	2-6°C, Na2S2O3, Dark	14 days	28 days (after extraction)
515.2	Herbicides	80 mL	2-40 mL amber G vials	2-6°C, Na2S2O3 or Sodium sulfite, HCl pH<2 Dark	14 days	14 days (after extraction)
515.3	Herbicides	80 mL	2-40 mL amber G vials	2-6°C, Na2S2O3, Dark	14 days	14 days (after extraction)
515.4	Herbicides	80 mL	2-40 mL amber G vials	<10 °C for first 48hrs. <6 °C therafter, Sodium sulfite, Dark	14 days	< 0°C, 21days (after extraction)
524.2	Volatiles and/or THMs	120 mL	3-40 mL G vials	2-6°C, ascorbic acid or Na2S2O3, HCl pH<2 in field	N/A	14 days

Drinking Water – cont'd

Method	Parameter	Amount	Container	Preservative	Hold Time	
					Prep.	Analysis
525.2	Semi-volatiles	2000 mL	2-1L amber G	2-6ºC, Sodium sulfite, HCl pH<2 in field	14 days (see method for exceptions)	30 days (after extraction)
531.1	Carbamates	80 mL	2-40 mL G vials	2-6ºC, $Na_2S_2O_3$, MCA in field pH<3	N/A	28 days
531.2	Carbamates	80 mL	2-40 mL G vials	$Na_2S_2O_3$, PDC buffer to pH 4, <10°C for 24 hrs, <6°C thereafter	N/A	28 days
547	Glyphosate	80 mL	2-40 mL G vials	2-6ºC, $Na_2S_2O_3$	N/A	14 days (18 months frozen)
548.1	Endothall	80 mL	2-40 mL G vials	2-6ºC Dark, $Na_2S_2O_3$, HCL pH 1.5 - 2 if high biological activity	7 days	14 days (after extraction)
549.2	Diquat/Paraquat	500 mL	1-500 mL amber P	2-6°C Dark, $Na_2S_2O_3$, H_2SO_4 pH < 2 if high biological activity.	7 days	21 days (after extraction)
550, 550.1	PAHs (PNAs)	2000mL	2-1L amber G	2-6°C Dark, $Na_2S_2O_3$, HCl pH <2	7 days	550, 30 days 550.1, 40 days (after extraction)
551.1	D/DBP	120 mL	3-40 mL G vials	2-6°C, Sodium Sulfate, Ammonium Chloride, pH 4.5 - 5.0 with PO_4 buffer	N/A	14 days
552.1	Haloacetic Acids	150 mL	2-125 mL amber G	2-6°C Dark, Ammonium Chloride	28 Days	48 hours (after extraction)
1613	Dioxin	1000 mL	2-1L amber G	2-6°C Dark, $Na_2S_2O_3$	N/A	40 days (recommended)
Radchem	Radiological	1 Gallon	1 Gallon P	2-6°C	N/A	6 months
2150B	Odor	500 mL AQ	1-1L G	2-6°C	N/A	24 hours

Drinking Water – cont'd

Method	Parameter	Amount	Container	Preservative	Hold Time	
					Prep.	Analysis
300.0 4500-P E	Phosphorus, ortho	150 mL AQ	1-1L amber G	Filter on site, 2-6°C	N/A	48 hours
		50 g Solid	1-125 mL G	2-6°C	N/A	Not established

Inorganics – Other than Drinking Water

Method	Parameter	Amount	Container	Preservative	Hold Time	
					Prep.	Analysis
2310 B	Acidity	100 mL	1-1L P	2-6ºC	N/A	14 days
2320B, 310.2	Alkalinity	100 mL	1-1L P	2-6°C	N/A	14 days
4500-NH3 D, 351.1 or 351.4 4500 B & E	Ammonia, TKN, Total Phosphorus	500 mL AQ	1-500 mL P	2-6°C, H_2SO_4, pH<2	N/A	28 days
		50 g Solid	1-250 mL G	2-6°C	N/A	Not established
5210 B	BOD	1000 mL AQ	1-1L P	2-6°C	N/A	48 hours
5220 D	COD	50 mL AQ	1-500 mL P	2-6°C, H_2SO_4, pH<2	N/A	28 days
300.0	Bromide, Chloride, Fluoride, Sulfate	50 mL AQ	1-1L P	2-6°C	N/A	28 days
		20 g Solid	1-125 mL G	2-6°C	N/A	Not established
300.0 4500-NO2 B	Nitrate, nitrite	100 mL AQ	1-500 mL P	2-6°C	48 hours	48 hours
		20 g Solid	1-125 mL G	2-6°C	Not established	48 hours following leach
300	Nitrate + Nitrite	100 mL AQ	1-500 mL P	2-6°C, H_2SO_4, pH<2	N/A	28 days
2120 B, C, E	Color	50 mL AQ	1-1L P	2-6°C	N/A	48 hours
2510 B, 120.1	Conductivity	100 mL AQ	1-1L P	2-6°C	N/A	28 days
4500CN B 335.3 4500CN G 335.1	Cyanide - total Cyanide - amenable	500 mL AQ	1-500 mL P	2-6°C, NaOH pH>12,	N/A	14 days
		20 g Solid	1-125 mL G	2-6°C	N/A	Not established
1010A, 1020B	Flashpoint / Ignitability	100 mL AQ	1-1L G	2-6°C	N/A	28 days

Inorganics – Other than Drinking Water

Method	Parameter	Amount	Container	Preservative	Hold Time	
					Prep.	Analysis
1030	Flashpoint / Ignitability	50 g Solid	1-125 mL G	2-6°C	N/A	28 days
5540C	MBAS (surfactants)	500 mL AQ	1-1L P	2-6°C	N/A	48 hours
1664A	Oil & grease	1000 mL AQ	1-1L G	2-6°C, HCl or H_2SO_4, pH<2	N/A	28 days
9095	Paint Filter	100 mL AQ	1-1L P	2-6ºC	N/A	Not established
		50 g Solids	1-125 mL G	2-6ºC		
4500 H+ B 9040	pH (water)	50 mL AQ	1-1L P	None	N/A	Immediately
9045	pH (soil)	50 mL Solid	P, G	None	N/A	Immediately
420.1	Phenols	500 mL AQ	1-1L G	2-6°C, H_2SO_4, pH<2	N/A	28 days
9065	Phenolics	100 g Solid	1-125 mL G	2-6°C		
300.0 4500-P E	Phosphorus, ortho	150 mL AQ	1-1L amber G	Filter on site, 2-6°C	N/A	48 hours
		50 g Solid	1-125 mL G	2-6°C	N/A	Not established
4500-P, B & E	Phosphorus, Total	150 mL AQ	1-1L amber G	2-6°C, H_2SO_4, pH<2	N/A	28 days
		50 g Solid	1-125 mL G	2-6°C	N/A	Not established
2540 C	Solids, T. Dissolved	100 mL AQ	1-1L P	2-6ºC	N/A	7 days
2540 F	Solids, settleable	1000 mL AQ	1-1L P	2-6°C	N/A	48 hours
2540 D	Solids, suspended	500 mL AQ	1-1L P	2-6°C	N/A	7 days
2540 B	Solids, total	500 mL AQ	1-1L P	2-6°C	N/A	7 days
		50 g Solid	1-125 mL G	2-6°C	N/A	7 days
160.4	Solids, volatile	500 mL AQ	1-1L P	2-6°C	7 days	7 days
		50 g Solids	1-125 mL G	2-6ºC	7 days	7 days

Inorganics – Other than Drinking Water

Method	Parameter	Amount	Container	Preservative	Hold Time	
					Prep.	Analysis
2540 G	Total, Fixed and Volatile solids in Sludge	50 g Solids	1-125 mL G	2-6ºC	7 days	7 days
4500 S D	Sulfide	500 mL AQ	1-1L P	2-6°C, NaOH pH>9, ZnAC	N/A	7 days
		50 g Solid	1-125 mL G	2-6°C	N/A	Not established
5310 C 9060A	TOC	100 mL AQ	1-250 mL G amber	2-6°C, H_2SO_4, pH<2	N/A	28 days
		50 g Solid	1-125 mL G	2-6°C		
9020 B	TOX	500 mL AQ	1-1L G amber	2-6°C, H_2SO_4, no head space	N/A	28 days
		50 g Solid	1-125 mL G	2-6°C		
180.1	Turbidity	100 mL AQ	1-1L P	2-6°C	N/A	48 hours
9221 - Soil / Sludge	Total and Fecal Coliforms by MPN	100 grams	2-120 mL P (sterile)	<10°C, Sterile, Na2S2O3	N/A	6 hours
9215/ Simplate	Heterotrophic Plate Count	100 mL	2-120 mL P (sterile)	<10°C, $Na_2S_2O_3$	N/A	6 hours
9221	Coliform - Total, Fecal, *E. Coli* - MPN	100 mL	2-120 mL P (sterile)	<10°C, $Na_2S_2O_3$	N/A	6 hours
9222	Coliform, Fecal MF	100 mL	2-120 mL P (sterile)	<10°C, $Na_2S_2O_3$	N/A	6 hours
9223	Coliforms, total and *E. Coli*	100 mL	2-120 mL P (sterile)	<10°C, $Na_2S_2O_3$	N/A	6 hours

Metals

Method	Parameter	Amount	Container	Preservative	Hold Time	
					Prep.	Analysis
200, 6010, 6020, 7000	All metals except Cr(VI) and Hg	200 mL 20 g Solid	1-1L P 1-250 mL G	HNO_3, pH<2	N/A	6 months
245, 7470, 7471	Mercury	200 mL 20 g Solid	1-1L P 1-250 mL G	HNO_3, pH<2	N/A	6 months
218, 3500	Chromium, Hex	200 mL	1-1L P	2-6°C	N/A	24 hours
7196, 7197	Chromium, Hex	20 g Solid	1-250 mL G	2-6°C	30 days	4 days

Organics – Other than Drinking Water

Method	Parameter	Amount	Container	Preservative	Hold Time	
					Prep.	Analysis
8015 W	Non-halogenated Volatiles	80 mL	2-40mL G vials	2-6°C, HCl , pH<2	14 days	14 days
8015AZ S	Non-halogenated Volatiles	100 g	1-4oz jar	2-6°C	14 days	14 days
8041A W	Phenols	1000 mL	2-1L G amber	2-6°C	7 Days	40 days (after extraction)
8041A S	Phenols	100 g	1-8 oz G jar	2-6°C	14 Days	40 days (after extraction)
8061A W	Phthalate esters	1000 mL	2-1L G amber	2-6°C	7 Days	40 days (after extraction)
8061A S	Phthalate esters	100 g	1-8oz G jar	2-6°C	14 Days	40 days (after extraction)
608 8081A W	Pesticides (608 includes PCBs)	1000 mL	2-1L G amber	2-6°C; $Na_2S_2O_3$ if chlorinated, pH: 5-9	7 Days	40 days (after extraction)
8081A (oil)	Pesticides	80 mL	2-40mL G vials	2-6°C	14 Days	40 days (after extraction)
8081A S	Pesticides	100 g	1-8oz G jar	2-6°C	14 Days	40 days (after extraction)
8082 W	PCBs	1000 mL	2-1L G amber	2-6°, pH: 5-9	7 Days	40 days (after extraction)
8082 (oil)	PCBs	80 mL	2-40mL G vials	2-6°C	14 Days	40 days (after extraction)
8082 S	PCBs	100 g	1-8oz G jar	2-6°C	14 Days	40 days (after extraction)

Organics – Other than Drinking Water – cont'd

Method	Parameter	Amount	Container	Preservative	Hold Time	
					Prep.	Analysis
8091 W	Nitroaromatics and Ketones	1000 mL	2-1L G amber	2-6°C	7 Days	40 days (after extraction)
610,8310W	PAHs	1000 mL	2-1L G amber	2-6ºC, $Na_2S_2O_3$ if chlorinated	7 Days	40 days (after extraction)
8310 S	PAHs	100 g	1-8oz G jar	2-6ºC	14 Days	40 days (after extraction)
8100 S	PAHs	100 g	1-8oz G jar	2-6°C	7 Days	40 days (after extraction)
8100 S	PAHs	1000 mL	2-1L G amber	2-6°C	14 Days	40 days (after extraction)
614 8141AW 1657	Organophos-phorus Pesticides	1000 mL	2-1L G amber	2-6°C	7 Days	40 days (after extraction)
8141A S	Organophos-phorus Pesticides	100 g	1-8oz G amber	2-6°C	14 Days	40 days (after extraction)
8151W	Chlorinated Herbicides	1000 mL	2-1L G amber	2-6°C	7 Days	40 days (after extraction)
8151A S	Chlorinated Herbicides	100 g	1-8oz G jar	2-6°C	14 days	14 days (after extraction)
624 8260B W	Volatile Organics (GC/MS)	120 mL	3-40mL G vials	2-6°C, $Na_2S_2O_3$, if chlorinated, 1:1 HCl	14 days	14 days
624	Acrolein, Acrylonitrile (ACAC) & 2-Chloroethylvinyl ether(2CEVE)	120 mL	3-40mL G vials	2-6°C, Dechlorinate, then collect in unpreserved vials	ACAC - 3 days 2CEVE - 14 days	ACAC - 3 days 2CEVE - 14 days
8260 W	2-Chloroethyl vinyl ether	120 mL	3-40mL G vials	2-6°C, Collect in unpreserved vials	14 days	14 days
8260B S	Volatile Organics (GC/MS)	100 g	Brass sleeve	2-6°C	48hrs	14 days
			Encore sampler		48hrs	14 days
			Field MeOH Ext.		14 days	14 days
TO-15	Volatile Organics (GC/MS)	1 Canister	1 Canister	None	14 days	14 days (from Collection
625,8270C W	Semi-volatiles	1000 mL	2-1L G amber	2-6°C, $Na_2S_2O_3$ if chlorinated	-10 °C 7 Days	40 days (after extraction)
8270C S	Semi-volatiles	100 g	1-8oz G jar	2-6°C	-10 °C 7 Days	40 days (after extraction)

Organics – Other than Drinking Water – cont'd

Method	Parameter	Amount	Container	Preservative	Hold Time	
					Prep.	Analysis
8330 S	Explosives	100 g	1-8oz G jar	2-6ºC - Dark	14 Days	40 days (after extraction)

Notes: For holding time 7,30 (or X,Y) means 7 (X) days for extraction, plus 30 (Y) additional days for analysis.
P = Plastic, G = Glass
Na2S2O3 = Sodium thiosulfate H2SO4 = Sulfuric acid
HCL = Hydrochloric acid MCA = Monochloroacetic acid
* Bulk sample may not be acceptable for some ADEQ programs.

Radiological

Method	Parameter	Amount	Container	Preservative	Hold Time	
					Prep.	Analysis
600/00-02	Gross Alpha	4000 mL AQ	1-1Gallon P	HNO_3; pH<2	N/A	6 months
900	Radiological, all except Rn222 and Tritium	4000 mL AQ	4-1L P	HNO_3; pH<2	N/A	6 months
		50 g solid	250 mL G jar	None	N/A	6 months
RN-222	Radon 222	80 mL	2x40 mL amber G	None	72 hours	72 hours
906	Tritium (H_3)	250 mL AQ	1-250 mL G	None	6 months	6 months
		300 g (Sample size varies with solid moisture content)	2 – 250 mL G jar	None	6 months	6 months
908	Uranium	1000 mL AQ	1-1L P or G	HCl; pH<2	6 months	6 months

P = Plastic, G = Glass, AQ = aqueous

Appendix 3. Industrial Hygiene Sample Containers

Industrial Hygiene Sample Receiving Guide

Analyte	Method Reference	Sample Media	Sampling Rate (Liters/Minute)	Air Volume (Liters)	Preservation	Sample Stability	Sample Storage
Acetaldehyde	Assay Technology(Mod)	AT N571 Passive Monitor	0.00977 L/min	8 Hrs	Should be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
Acetone	NIOSH 1300	150-mg Charcoal Tube	0.01 - 0.2	0.5 - 3	May be shipped on ice or equivalent; refrigerate upon receipt.	Undetermined	IH Refrigerator in SVOA Lab
	OSHA 69	225-mg Anasorb CMS Tube	0.05	3	May be shipped on ice or equivalent; refrigerate upon receipt.	17 Days	IH Refrigerator in SVOA Lab
	3M (Modified)	3M Badge (3500 or 3520)	0.0401	2 Hrs Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	3 Weeks	IH Refrigerator in SVOA Lab
	SKC (Modified)	SKC 575-002 Passive Badge	0.0152	8 Hrs Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
	Assay Technology(Mod)	Assay N541 or N546 Badge	0.00640 (#541) 0.00160 (#546)	8 Hrs Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
Acetonitirile	3M (Modified)	3M 3500 or 3520	0.0482	2 Hrs	May be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
Acrylonitrile	NIOSH 1604	150-mg Charcoal Tube	0.01 - 0.2	3.5 - 20	Should be shipped on ice or equivalent; refrigerate upon receipt.	7 Days	IH Refrigerator in SVOA Lab
	3M (Modified)	3M Badge (3500 or 3520)	0.0438	8 Hrs Max.	Should be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
Aluminum	N7300/OSHA ID-121	37-mm, 0.8-um, MCE Filter	1 - 4	5 - 960/5 - 100	Should be stored at room temperature.	Indefinite	Counter in Metal Lab Digestion Room
Antimony	N7300/OSHA ID-121	37-mm, 0.8-um, MCE Filter	1 - 4	30 - 960/50 - 2000	Should be stored at room temperature.	Indefinite	Counter in Metal Lab Digestion Room
Arsine	NIOSH 6001	150 mg Coconut shell charcoal tube	0.01 - 0.2	0.1 - 10	Should be stored at room temperature.	6 Days	Counter in Metal Lab Digestion Room
Arsenic	NIOSH 7300	37-mm, 0.8-um, MCE Filter	1 - 4	200-2000	Should be stored at room temperature.	Indefinite	Counter in Metal Lab Digestion Room
Barium	N7300/OSHA ID-121	37-mm, 0.8-um, MCE Filter	1 - 4	30 - 960/50 - 2000	Should be stored at room temperature.	Indefinite	Counter in Metal Lab Digestion Room
Benzaldehyde	Assay Technology(Mod)	Assay N571 Passive Badge	0.00581 L/min	8 Hrs	Should be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
Benzene	NIOSH 1501	150-mg Charcoal Tube	< 0.2	5 - 30	May be shipped on ice or equivalent; refrigerate upon receipt.	30 Days	IH Refrigerator in SVOA Lab
	3M (Modified)	3M Badge (3500 or 3520)	0.0355	8 Hrs Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	3 Weeks	IH Refrigerator in SVOA Lab
	SKC (Modified)	SKC 575-002 Passive Badge	0.0160	8 Hrs Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
	Assay Technology(Mod)	Assay N541 or N546 Badge	0.00385 (#541) 0.00096 (#546)	8 Hrs Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
Beryllium	NIOSH 7300	37-mm, 0.8-um, MCE Filter	1 - 4	100 - 2000	Should be stored at room temperature.	Indefinite	Counter in Metal Lab Digestion Room
Boron	NIOSH 7300	37-mm, 0.8-um, MCE Filter	1 - 4	25 - 2000	Should be stored at room temperature.	Indefinite	Counter in Metal Lab Digestion Room

Industrial Hygiene Sample Receiving Guide

Analyte	Method Reference	Sample Media	Sampling Rate (Liters/Minute)	Air Volume (Liters)	Preservation	Sample Stability	Sample Storage
Butane (n-Butane)	EPA 3C/ASTM D1946	Entech Canister	0.01 - 1	1 L	Should be stored at room temperature.	28 Days	IH Counter in SVOA Lab
	EPA 3C/ASTM D1946	Tedlar Bag	0.01 - 1	1 L	Should be stored at room temperature.	72 hHrs.	IH Counter in SVOA Lab
2-Butoxyethanol	NIOSH 1403	150-mg Charcoal Tube	0.01 - 0.05	2 - 10	Should be shipped on ice or equivalent; refrigerate upon receipt.	30 Days	IH Refrigerator in SVOA Lab
n-Butyl Acetate	NIOSH 1450	150-mg Charcoal Tube	0.01 - 0.2	1 - 10	May be shipped on ice or equivalent; refrigerate upon receipt.	30 Days	IH Refrigerator in SVOA Lab
	SKC (Modified)	SKC 575-002 Passive Badge	0.0132	8 Hrs Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
	Assay Technology(Mod)	Assay N541 or N546 Badge	0.00348 (#541) 0.00087 (#546)	8 Hrs Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
Butyraldehyde	Assay Technology(Mod)	Assay N671 Passive Badge	0.00683 L/min	8 Hrs	Should be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
Cadmium	NIOSH 7300	37-mm, 0.8-um, MCE Filter	1 - 4	13 - 2000	Should be stored at room temperature.	Indefinite	Counter in Metal Lab Digestion Room
Calcium	N7300/OSHA ID-121	37-mm, 0.8-um, MCE Filter	1 - 4	30 - 960/5 - 2000	Should be stored at room temperature.	Indefinite	Counter in Metal Lab Digestion Room
Carbon Black	NIOSH 5000	37-mm pre-weighed PVC Filter, 5-um pore size	1 - 2	30 - 570	Should be stored at room temperature.	Indefinite	IH Drawer/Bin in SVOA Lab
Carbon Dioxide	EPA 3C/ASTM D1946	Entech Canister	400ml or 1 L	Grab or Time integrated	Should be stored at room temperature.	28 Days	IH Counter in SVOA Lab
	EPA 3C/ASTM D1946	Tedlar Bag	1 L	Grab	Should be stored at room temperature.	72 Hrs	IH Counter in SVOA Lab
Carbon Monoxide	EPA 3C/ASTM D1946	Entech Canister	400ml or 1 L	Grab or Time integrated	Should be stored at room temperature.	28 Days	IH Counter in SVOA Lab
	EPA 3C/ASTM D1946	Tedlar Bag	1 L	Grab	Should be stored at room temperature.	72 Hrs	IH Counter in SVOA Lab
Carbon Tetrachloride	NIOSH 1003	150-mg Charcoal Tube	0.01 - 0.2	3 - 150	May be shipped on ice or equivalent; refrigerate upon receipt.	30 days	IH Refrigerator in SVOA Lab
	3M (Modified)	3M Badge (3500 or 3520)	0.0302	8 Hrs Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	21 Days	IH Refrigerator in SVOA Lab
	SKC (Modified)	SKC 575-002 Passive Badge	0.0141	8 Hrs Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
	Assay Technology(Mod)	Assay N541 or N546 Badge	0.00514 (#541) 0.00128 (#546)	8 Hrs Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
Chlorobenzene	NIOSH 1003	150-mg Charcoal Tube	0.01 - 0.2	1.5 - 40	May be shipped on ice or equivalent; refrigerate upon receipt.	30 Days	IH Refrigerator in SVOA Lab
	3M (Mod)	3M Badge (3500 or 3520)	0.0293	8 Hrs Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
	SKC (Mod)	SKC 575-002 Passive Badge	0.0142	8 Hrs Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
	Assay Technology(Mod)	Assay N541 or N546 Badge	0.00408 (#541) 0.00102 (#546)	8 Hrs Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab

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Analyte	Method Reference	Sample Media	Sampling Rate (Liters/Minute)	Air Volume (Liters)	Preservation	Sample Stability	Sample Storage
Chloroform	NIOSH 1003	150-mg Charcoal Tube	0.01 - 0.2	1 - 50	May be shipped on ice or equivalent; refrigerate upon receipt.	30 Days	IH Refrigerator in SVOA Lab
	3M (Modified)	3M Badge (3500 or 3520)	0.0335	8 Hrs Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	21 Days	IH Refrigerator in SVOA Lab
	SKC (Modified)	SKC 575-002 Passive Badge	0.0130	8 Hrs Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
	Assay Technology (Mod)	Assay N541 or N546 Badge	0.00584 (#541) 0.00146 (#546)	8 Hrs Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
Chromium	NIOSH 7300	37-mm, 0.8-um, MCE Filter	1 - 4	30 - 1000	Should be stored at room temperature.	Indefinite	Counter in Metal Lab Digestion Room
Coal Tar Pitch Volatiles	NIOSH 5506 (PAHs):Anthracne, benzo(a)pyrene, chrysene, phenanthrene, and pyrene.	37-mm, 2-um PTFE filter in series with a 120-mg XAD-2	2	200 - 1000	Should be shipped on ice or equivalent; refrigerate upon receipt.	Undetermined	IH Refrigerator in SVOA Lab
Cobalt	NIOSH 7300	37-mm, 0.8-um, MCE Filter	1 - 4	25 - 2000	Should be stored at room temperature.	Indefinite	Counter in Metal Lab Digestion Room
Copper	NIOSH 7300	37-mm, 0.8-um, MCE Filter	1 - 4	10 - 1000	Should be stored at room temperature.	Indefinite	Counter in Metal Lab Digestion Room
Cresols	NIOSH 2546	150-mg XAD-7 Tube	0.01 - 0.1	1 - 24	Should be shipped on ice or equivalent; refrigerate upon receipt.	Undetermined	IH Refrigerator in SVOA Lab
Crotonaldehyde	Assay Technology(Mod)	AT N571 Passive Monitor	0.00716 L/min	8 Hrs	Should be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
Cumene	NIOSH 1501	150-mg Charcoal Tube	< 0.2	1 - 30	May be shipped on ice or equivalent; refrigerate upon receipt.	30 Days	IH Refrigerator in SVOA Lab
	3M (Modified)	3M Badge (3500 or 3520)	0.0245	8 Hrs Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
	SKC (Modified)	SKC 575-002 Passive Badge	0.0128	8 Hrs Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
	Assay Technology(Mod)	Assay N541 or N546 Badge	0.00331 (#541) 0.00083 (#546)	8 Hrs Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
Diborane	NIOSH 6006	PTFE filter + oxidizer impregnated charcoal tube	0.5 - 1.0	60 - 260	Should be stored at room temperature.	7 Days	Counter in Metal Lab Digestion Room
1,1-Dichloroethane	NIOSH 1003	150-mg Charcoal Tube	0.01 - 0.2	0.5 - 15	May be shipped on ice or equivalent; refrigerate upon receipt.	30 Days	IH Refrigerator in SVOA Lab
1,2-Dichloroethane	NIOSH 1003	150-mg Charcoal Tube	0.01 - 0.2	1 - 50	May be shipped on ice or equivalent; refrigerate upon receipt.	30 Days	IH Refrigerator in SVOA Lab
Diethyl Ether (Ethyl ether, Ethyl oxide)	3M (Modified)	3M 3520 Passive Monitor	0.0368	4 Hr	May be shipped on ice or equivalent; refrigerate upon receipt.	3 Weeks	IH Refrigerator in SVOA Lab
2,5-Dimethylbenzaldehyde	Assay Technology(Mod)	AT N571 Passive Monitor	0.00479 L/min	8 Hrs	Should be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
1,4-Dioxane	NIOSH 1602	150-mg Charcoal Tube	0.01 - 0.2	0.5 - 15	May be shipped on ice or equivalent; refrigerate upon receipt.	42 Days	IH Refrigerator in SVOA Lab
Epichlorohydrin	NIOSH 1010	150-mg Charcoal Tube	0.01 - 0.2	2 - 30	May be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab

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Analyte	Method Reference	Sample Media	Sampling Rate (Liters/Minute)	Air Volume (Liters)	Preservation	Sample Stability	Sample Storage
Ethane	EPA 3C/ASTM D1946	Entech Canister	0.01 - 1	1 L	Should be stored at room temperature.	28 Days	IH Counter in SVOA Lab
	EPA 3C/ASTM D1946	Tedlar Bag	0.01 - 1	1 L	Should be stored at room temperature.	72 Hours	IH Counter in SVOA Lab
Ethanol	NIOSH 1400	150-mg Charcoal Tube	0.05	0.1 - 10	May be shipped on ice or equivalent; refrigerate upon receipt.	Undetermined	IH Refrigerator in SVOA Lab
	3M (Modified)	3M 3520 Passive Monitor	0.0437	1 Hr Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	21 Days	IH Refrigerator in SVOA Lab
	SKC (Modified)	SKC 575-002 Passive Badge	0.0209	4 Hrs Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
	Assay Technology(Mod)	Assay N541 or N546 Badge	0.00615 (#541) 0.00154 (#546)	8 Hrs Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
Ethyl Acetate	NIOSH 1457	150-mg Charcoal Tube	0.01 - 0.2	0.1 - 10	May be shipped on ice or equivalent; refrigerate upon receipt.	6 Days	IH Refrigerator in SVOA Lab
	SKC (Modified)	SKC 575-002 Passive Badge	0.0144	8 Hrs Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
Ethylbenzene	NIOSH 1501	150-mg Charcoal Tube	< 0.2	1 - 24	May be shipped on ice or equivalent; refrigerate upon receipt.	30 Days	IH Refrigerator in SVOA Lab
	SKC (Modified)	SKC 575-002 Passive Badge	0.01383	8 Hrs Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
	Assay Technology(Mod)	Assay N541 or N546 Badge	0.00363 (#541) 0.00091 (#546)	8 Hrs Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
Ethylene Oxide	EPA TO-15	Entech Canister	400ml or 1 L	Grab or Time Integrated	Should be stored at room temperature.	10 Days	Voa Lab-Room temperature
Fixed Gas Screen (CO_2, CO, CH_4, N_2, O_2)	EPA 3C/ASTM D1946	Entech Canister	400 mL or 1L	Grab or Time Integrated	Should be stored at room temperature.	28 Days	IH Counter in SVOA Lab
	EPA 3C/ASTM D1946	Tedlar Bag	1 L	Grab	Should be stored at room temperature.	72 Hrs	IH Counter in SVOA Lab
Formaldehyde	NIOSH 2016 (Modified)	DNPH-coated Silica Gel	0.03 - 1.5	1 - 15	Should be shipped on ice or equivalent; refrigerate upon receipt.	34 Days	IH Refrigerator in SVOA Lab
	Assay Technology(Mod)	AT N571 Passive Monitor	0.01305 L/min	8 Hrs	Should be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
	SKC, NIOSH 2016 (Mod)	SKC UMEx-100 Passive Badge	28.6	15 min. or 8 Hrs	Should be shipped on ice or equivalent; refrigerate upon receipt.	21 Days	IH Refrigerator in SVOA Lab
Gasoline Range Hydrocarbons	EPA TO-15 (Modified)	Entech Canister	400ml or 1 L	Grab or Time Integrated	Should be stored at room temperature.	10 Days	IH Refrigerator in SVOA Lab
Glutaraldehyde	OSHA 64 (Modified)	DNPH-coated Glass Fiber Filters	1 - 2	15 - 120	Should be shipped on ice or equivalent; refrigerate upon receipt.	17 Days	IH Refrigerator in SVOA Lab
	NIOSH 2532 (Mod)	DNPH-coated Silica Gel	0.05 - 0.5	1 - 30	Should be shipped on ice or equivalent; refrigerate upon receipt.	30 Days	IH Refrigerator in SVOA Lab
	Assay Technology(Mod)	AT N571 Passive Monitor	0.00603 L/min	8 Hrs	Should be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
Hexaldehyde	Assay Technology(Mod)	AT N571 Passive Monitor	0.00540 L/min	8 Hrs	Should be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab

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Analyte	Method Reference	Sample Media	Sampling Rate (Liters/Minute)	Air Volume (Liters)	Preservation	Sample Stability	Sample Storage
1,6-Hexamethylene Diisocyanate (1,6-HDI)	OSHA 42	37-mm Glass Fiber Filter coated with 1,2PP	1 L/min	15	Should be shipped on ice or equivalent; refrigerate upon receipt.	18 Days	IH Refrigerator in SVOA Lab
Hexane (n-Hexane)	NIOSH 1500	150-mg Charcoal Tube	0.01 - 0.2	Undetermined	May be shipped on ice or equivalent; refrigerate upon receipt.	30 Days	IH Refrigerator in SVOA Lab
	3M (Modified)	3M Badge (3500 or 3520)	0.032	8 Hrs Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	3 Weeks	IH Refrigerator in SVOA Lab
	SKC (Modified)	SKC 575-002 Passive Badge	0.0143	8 Hrs Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
	EPA 3C/ASTM D1946	Tedlar Bag	1 L	Grab	Should be stored at room temperature.	72 Hrs	IH Counter in SVOA Lab
	EPA 3C/ASTM D1946	Entech Canister	0.01 - 1	1 L	Should be stored at room temperature.	28 Days	IH Counter in SVOA Lab
2-Hexanone	NIOSH 1300	150-mg Charcoal Tube	0.01 - 0.2	1 - 10	Should be shipped on ice or equivalent; refrigerate upon receipt.	7 Days	IH Refrigerator in SVOA Lab
Hexavalent Chromium (Soluble)	NIOSH 7600	37-mm PVC Filter, 5-mm	1 - 4	8 - 400	Should be stored at room temperature.	14 Days	IH Drawer/Bin in SVOA Lab
Hydrobromic Acid	NIOSH 7903	600-mg Cleaned Silica Gel Tube	0.2 - 0.5	3 - 100	Should be stored at room temperature.	21 Days	IH Drawer/Bin in SVOA Lab
Hydrochloric Acid	NIOSH 7903	600-mg Cleaned Silica Gel	0.2 - 0.5	3 - 100	Should be stored at room temperature.	21 Days	IH Drawer/Bin in SVOA Lab
Hydrofluoric Acid	NIOSH 7903	600-mg Cleaned Silica Gel	0.2 - 0.3	3 - 100	Should be stored at room temperature.	21 Days	IH Drawer/Bin in SVOA Lab
Hydrogen Cyanide	NIOSH 6010	800-mg Soda Lime Tube	0.05 - 0.2	2 - 90	Should be stored at room temperature.	14 Days	IH Drawer/Bin in SVOA Lab
Iron	N7300/OSHA ID-121	37-mm, 0.8-um, MCE Filter	1 - 4	5 - 960/5 - 100	Should be stored at room temperature.	Indefinite	Counter in Metal Lab Digestion Room
Isopropanol	NIOSH 1400	150-mg Charcoal Tube	0.01 - 0.2	0.3 - 3	May be shipped on ice or equivalent; refrigerate upon receipt.	Undetermined	IH Refrigerator in SVOA Lab
	SKC (Modified)	SKC 575-002 Passive Badge	0.0178	4 Hrs Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
Isovaleraldehyde	Assay Technology(Mod)	AT N571 Passive Monitor	0.00601 L/min	8 Hrs	Should be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
Lead	NIOSH 7300	37-mm, 0.8-um, MCE Filter	1 - 4	50 - 2000	Should be stored at room temperature.	Indefinite	Counter in Metal Lab Digestion Room
Lithium	NIOSH 7300	37-mm, 0.8-um, MCE Filter	1 - 4	100 - 2000	Should be stored at room temperature.	Indefinite	Counter in Metal Lab Digestion Room
Magnesium	N7300/OSHA ID-121	37-mm, 0.8-um, MCE Filter	1 - 4	30 - 960/ 5 - 67	Should be stored at room temperature.	Indefinite	Counter in Metal Lab Digestion Room
Manganese	N7300/OSHA ID-121	37-mm, 0.8-um, MCE Filter	1 - 4	5 - 960/5 - 200	Should be stored at room temperature.	Indefinite	Counter in Metal Lab Digestion Room
Mercury	NIOSH 6009	200-mg Anasorb C300 Tube	0.15 - 0.25	2 - 100	Should be stored at room temperature.	30 Days	Counter in Metal Lab Digestion Room
Mercury	OSHA ID-140	800-mg Anasorb C300 Capsule/Badge	0.02	9.6	Should be stored at room temperature	30 Days	Counter in Metal Lab Digestion Room

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Analyte	Method Reference	Sample Media	Sampling Rate (Liters/Minute)	Air Volume (Liters)	Preservation	Sample Stability	Sample Storage
Methane	EPA 3C/ASTM D1946	Entech Canister	Grab or Time integrated	400 mL or 1L	Should be stored at room temperature.	28 Days	IH Counter in SVOA Lab
	EPA 3C/ASTM D1946	Tedlar Bag	Grab	1 L	Should be stored at room temperature.	72 Hrs	IH Counter in SVOA Lab
	EPA 3C/ASTM D1946	Entech Canister	Grab or Time Integrated	400 mL or 1 L	Should be stored at room temperature.	28 Days	IH Counter in SVOA Lab
	EPA 3C/ASTM D1946	Tedlar Bag	Grab	1	Should be stored at room temperature.	72 Hrs.	IH Counter in SVOA Lab
Methanol	NIOSH 2000	150-mg Silica Gel Tube	0.02 - 0.2	1 - 5	Should be shipped on ice or equivalent; refrigerate upon receipt.	30 Days	IH Refrigerator in SVOA Lab
4-4'-Methylene Bisphenyl Isocyanate (4,4'-MDI)	OSHA 47	37-mm Glass Fiber Filter coated with 1,2PP	1 L/min	15	Should be shipped on ice or equivalent; refrigerate upon receipt.	15 Days	IH Refrigerator in SVOA Lab
Methylal	NIOSH 1611	150-mg Charcoal Tube	0.1-0.2	1-3	Should be shipped on ice or equivalent; refrigerate upon receipt.	Unknown	IH Refrigerator in SVOA Lab
Methylene Chloride	NIOSH 1005	(2) Coconut Shell Charcoal Tubes in series, 150-mg each	0.01 - 0.2	0.5 - 2.5	May be shipped on ice or equivalent; refrigerate upon receipt.	30 Days	IH Refrigerator in SVOA Lab
	3M (Modified)	3M 3520 Passive Monitor	0.0379	6 Hrs Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	3 Weeks	IH Refrigerator in SVOA Lab
Methyl Ethyl Ketone	OSHA 1004	225-mg Anasorb CMS Tube	0.05	≤ 12	May be shipped on ice or equivalent; refrigerate upon receipt.	15 Days	IH Refrigerator in SVOA Lab
	3M (Modified)	3M Badge (3500 or 3520)	0.0363	8 Hrs Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	3 Weeks	IH Refrigerator in SVOA Lab
	SKC + OSHA 1004	SKC 575-002 Passive Badge	0.01688	8 Hrs Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	25 Days	IH Refrigerator in SVOA Lab
	Assay Technology(Mod)	Assay N541 or N546 Badge	0.00460 (#541) 0.00115 (#546)	8 Hrs Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
Methyl Isobutyl Ketone	OSHA 1004	225-mg Anasorb CMS Tube	0.05	≤ 12	May be shipped on ice or equivalent; refrigerate upon receipt.	15 Days	IH Refrigerator in SVOA Lab
	SKC + OSHA 1004	SKC 575-002 Passive Badge	0.01362	8 Hrs Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
	NIOSH 1300	150-mg Charcoal Tube	1 - 10	0.01 - 0.2	May be shipped on ice or equivalent; refrigerate upon receipt.	Undetermined	IH Refrigerator in SVOA Lab
	Assay Technology(Mod)	Assay N541 or N546 Badge	0.00368 (#541) 0.00092 (#546)	8 Hrs Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
Methyl Methacrylate	3M (Modified)	3M Badge (3500 or 3520)	0.0318	8 Hrs Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
	SKC (Modified)	SKC 575-002 Passive Badge	0.0131	8 Hrs Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	21 Days	IH Refrigerator in SVOA Lab
	Assay Technology(Mod)	Assay N541 or N546 Badge	0.00399 (#541) 0.00100 (#546)	8 Hrs Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
Mineral Oil Mist (Applicable to all TCFA soluable oil mists, no synthetic/semi synthetic fluids)	NIOSH 5026	37-mm PVC Filter, 5-um	1 - 3	20 - 500	Should be stored at room temperature.	60 days	IH Drawer/Bin in SVOA Lab

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Molybdenum	N7300/OSHA ID-121	37-mm, 0.8-um, MCE Filter	1 - 4	5 - 960/5 - 67	Should be stored at room temperature.	Indefinite	Counter in Metal Lab Digestion Room
Naphthas (client must submit bulk liquid sample to be used as reference material)	NIOSH 1550	150-mg Charcoal Tube	0.01 - 0.2	1.3 - 20	May be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
Natural Gas Screen (CH_4, C_2H_6, C_3H_8, C_4H_{10}, C_5H_{12}, C_6H_{14})	EPA 3C/ASTM D1946	Entech Canister	400ml or 1 L	Grab or Time Integrated	Should be stored at room temperature.	28 Days	IH Counter in SVOA Lab
	EPA 3C/ASTM D1946	Tedlar Bag	Grab	1	Should be stored at room temperature.	72 Hrs.	IH Counter in SVOA Lab
Nickel	NIOSH 7300	37-mm, 0.8-um, MCE Filter	1 - 4	5 - 1000	Should be stored at room temperature.	Indefinite	Counter in Metal Lab Digestion Room
Nicotine	NIOSH 2551	120-mg XAD-4 Tube	0.1 - 1	0.5 - 600	Should be shipped on ice or equivalent; refrigerate upon receipt. Avoid Light exposure.	14 Days/Dark	IH Refrigerator in SVOA Lab
Nitric Acid	NIOSH 7903	600-mg Cleaned Silica Gel Tube	0.2 - 0.5	3 - 100	Should be stored at room temperature.	21 Days	IH Drawer/Bin in SVOA Lab
Nitrogen	EPA 3C/ASTM D1946	Entech Canister	400ml or 1 L	Grab or Time Integrated	Should be stored at room temperature.	28 Days	IH Counter in SVOA Lab
	EPA 3C/ASTM D1946	Tedlar Bag	1 L	Grab	Should be stored at room temperature.	72 Hrs	IH Counter in SVOA Lab
Octane (n-Octane)	NIOSH 1500	150-mg Charcoal Tube	0.01 - 0.2	4	May be shipped on ice or equivalent; refrigerate upon receipt.	30 Days	IH Refrigerator in SVOA Lab
	3M (Modified)	3M Badge (3500 or 3520)	0.0266	8 Hrs Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
	SKC (Modified)	SKC 575-002 Passive Badge	0.0127	8 Hrs Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
	Assay Technology(Mod)	Assay N541 or N546 Badge	0.00313 (#541) 0.00078 (#546)	8 Hrs Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
Oxygen	EPA 3C/ASTM D1946	Entech Canister	400ml or 1 L	Grab or Time Integrated	Should be stored at room temperature.	28 Days	IH Counter in SVOA Lab
	EPA 3C/ASTM D1946	Tedlar Bag	1 L	Grab	Should be stored at room temperature.	72 Hrs	IH Counter in SVOA Lab
Particulates, Respirable Dusts	NIOSH 0600	37-mm pre-weighed PVC Filter, 5-um pore size, w/al cyclone	2.5	20 - 400	Should be stored at room temperature.	Indefinite	IH Drawer/Bin in SVOA Lab
Particulates, Total Dusts	NIOSH 0500	37-mm pre-weighed PVC Filter, 5-um pore size	1 - 2	7 - 133	Should be stored at room temperature.	Indefinite	IH Drawer/Bin in SVOA Lab
Pentane (n-Pentane)	NIOSH 1500	150-mg Charcoal Tube	0.01 - 0.4	2	Should be shipped on ice or equivalent; refrigerate upon receipt.	30 Days	IH Refrigerator in SVOA Lab
	3M (Modified)	3M 3520 Passive Monitor	0.0353	3 Hrs Max.	Should be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
	SKC (Modified)	SKC 575-002 Passive Monitor	0.0149	8 Hrs Max.	Should be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
	Assay Technology(Mod)	Assay N541 or N546 Badge	0.00418 (#541) 0.00105 (#546)	8 Hrs Max.	Should be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
	EPA 3C/ASTM D1946	Entech Canister	400ml or 1 L	Grab or Time Integrated	Should be stored at room temperature.	28 Days	IH Counter in SVOA Lab
	EPA 3C/ASTM D1946	Tedlar Bag	1 L	Grab	Should be stored at room temperature.	72 Hrs	IH Counter in SVOA Lab

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Pesticides, Organophosphorus	NIOSH 5600	OVS-2 Tube; 13-mm Quartz Filter with 410-mg XAD-2	0.2 - 1	12 - 240	Should be shipped on ice or equivalent; refrigerate upon receipt.	30 Days	IH Refrigerator in SVOA Lab
Phenol	NIOSH 2546	150-mg XAD-7 Tube	0.01 - 0.1	1 - 24	Should be shipped on ice or equivalent; refrigerate upon receipt.	Undetermined	IH Refrigerator in SVOA Lab
4-Phenylcyclohexene	OSHA Mod.	150 mg Charcoal Tube	0.5-2.0	10-1200	In Dvlpmt	Undetermined	In Dvlpmt
Phosphine	OSHA 1003	37-mm glass fiber filter with a mercuric chloride treated polyester filter	TWA: 1.0 STEL: 2.0	TWA: 240 L max STEL: 30 L max	Should be shipped on ice or equivalent; refrigerate upon receipt.	17 Days (filter extremely short holdtime)	IH Refrigerator in SVOA Lab
Phosphoric Acid	NIOSH 7903	600-mg Cleaned Silica Gel	0.2 - 0.5	3 - 100	Should be stored at room temperature.	21 Days	IH Drawer/Bin in SVOA Lab
Polychlorinated Biphenyls (PCBs) - Aroclors 1016, 1221, 1232, 1242, 1248, 1254, and 1260.	NIOSH 5503	13-mm, Glass fiber filter in series with a 150-mg Florisil	0.05 - 0.2	1 - 50	Should be shipped on ice or equivalent; refrigerate upon receipt.	2 Months for Tubes	IH Refrigerator in SVOA Lab
Polynuclear Aromatic Hydrocarbons (PAH/PNA)	NIOSH 5506	37-mm, 2-um PTFE filter in series with a 120-mg XAD-2	2	200 - 1000	Should be shipped on ice or equivalent; refrigerate upon receipt.	Unknown - Protect from heat and light	IH Refrigerator in SVOA Lab
Potassium	N7300/OSHA ID-121	37-mm, 0.8-um, MCE Filter	1 - 2	30 - 960/5 - 1000	Should be stored at room temperature.	Indefinite	Counter in Metal Lab Digestion Room
Propane	EPA 3C/ASTM D1946	Entech Canister	400ml or 1 L	Grab or Time integrated	Should be stored at room temperature.	Undetermined	IH Drawer/Bin in SVOA Lab
	EPA 3C/ASTM D1946	Tedlar Bag	1 L	Grab	Should be stored at room temperature.	Undetermined	IH Drawer/Bin in SVOA Lab
Propionaldehyde	Assay Technology(Mod)	AT N571 Passive Badge	0.00798 L/min	8 Hours	Should be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
Pyridine	NIOSH 1613	150-mg Charcoal Tube	0.01-1.0	18-150	Should be shipped on ice or equivalent; refrigerate upon receipt.	Undetermined	IH Refrigerator in SVOA Lab
Selenium	N7300/OSHA ID-121	37-mm, 0.8-um, MCE Filter	1 - 4	60 - 2000/13 - 2000	Should be stored at room temperature.	Indefinite	Counter in Metal Lab Digestion Room
Silicon Tetrahydride (Silane)	OSHA CSI	15 mL of 0.01 N KOH in a MGFB	1.0 L/min Max	480 L Max	Should be stored at room temperature.	7 days	Counter in Metal Lab Digestion Room
Silver	N7300/OSHA ID-121	37-mm, 0.8-um, MCE Filter	1 - 4	60 - 2000/250 - 2000	Should be stored at room temperature.	Indefinite	Counter in Metal Lab Digestion Room
Sodium	N7300/OSHA ID-121	37-mm, 0.8-um, MCE Filter	1 - 4	30 - 2000/30 - 960	Should be stored at room temperature.	Indefinite	IH Bin in Metal Lab
Strontium	NIOSH 7300	37-mm, 0.8-um, MCE Filter	1 - 4	25 - 2000/10 - 1000	Should be stored at room temperature.	Indefinite	Counter in Metal Lab Digestion Room
Styrene	NIOSH 1501	150-mg Charcoal Tube	< 1.0	1 - 14	May be shipped on ice or equivalent; refrigerate upon receipt.	30 Days	IH Refrigerator in SVOA Lab
	SKC (Modified)	SKC 575-002 Passive Badge	0.0137	8 Hrs Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	21 Days	IH Refrigerator in SVOA Lab
	Assay Technology(Mod)	Assay N541 or N546 Badge	0.00375 (#541) 0.00094 (#546)	8 Hrs Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab

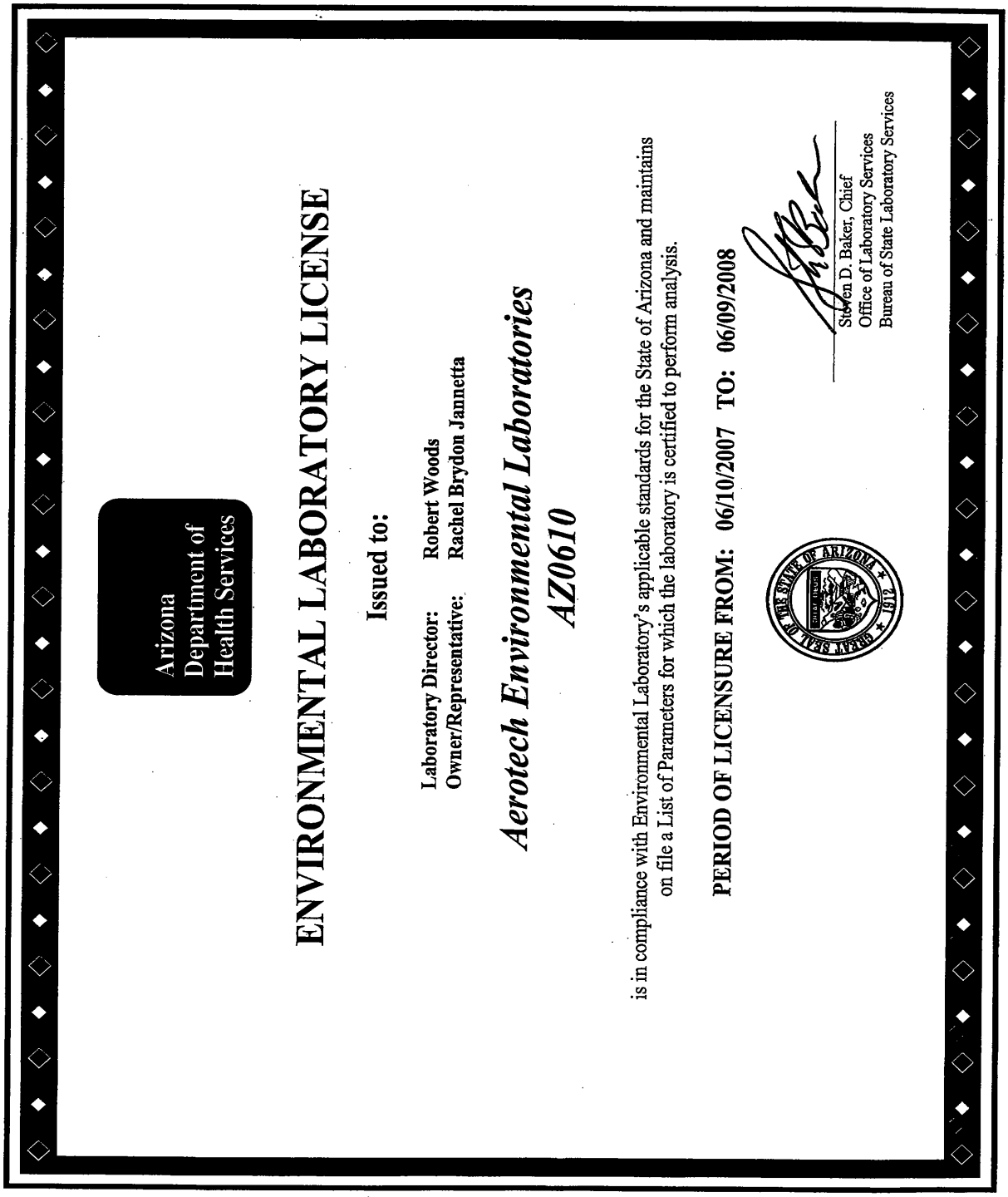
Industrial Hygiene Sample Receiving Guide

Analyte	Method Reference	Sample Media	Sampling Rate (Liters/Minute)	Air Volume (Liters)	Preservation	Sample Stability	Sample Storage
Sulfur Gases	EPA TO-15 (Modified)	Entech Canister	400ml or 1 L	Grab or Time integrated	Should be stored at room temperature.	14 Days	Voa Lab-Room temperature
Sulfuric Acid	NIOSH 7903	600-mg Cleaned Silica Gel	0.2 - 0.5	3 - 100	Should be stored at room temperature.	21 Days	IH Drawer/Bin in SVOA Lab
Tetrachloroethylene	NIOSH 1003	150-mg Charcoal Tube	0.01 - 0.2	1.0 - 40	May be shipped on ice or equivalent; refrigerate upon receipt.	30 Days	IH Refrigerator in SVOA Lab
	3M (Modified)	3M Badge (3500 or 3520)	0.0283	8 Hrs Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	21 Days	IH Refrigerator in SVOA Lab
	SKC (Modified)	SKC 575-002 Passive Badge	0.0131	8 Hrs Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
	Assay Technology(Mod)	Assay N541 or N546 Badge	0.00406 (#541) 0.00101 (#546)	8 Hrs Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
Tetrahydrofuran	NIOSH 1609	150-mg Charcoal Tube	0.01 - 0.2	1 - 9	May be shipped on ice or equivalent; refrigerate upon receipt.	Undetermined	IH Refrigerator in SVOA Lab
	3M (Modified)	3M Badge (3500 or 3520)	0.0372	8 Hrs Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
	SKC (Modified)	SKC 575-002 Passive Badge	0.0174	4 Hrs Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
	Assay Technology(Mod)	Assay N541 or N546 Badge	0.00485 (#541) 0.00121 (#546)	8 Hrs Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
Thallium	NIOSH 7300	37-mm, 0.8-um, MCE Filter	1 - 4	50 - 2000/25 - 2000	Should be stored at room temperature.	Indefinite	Counter in Metal Lab Digestion Room
Tolualdehyde	Assay Technology(Mod)	AT N571 Passive Badge	0.00524 L/min	8 Hours	Should be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
Toluene	NIOSH 1501	150-mg Charcoal Tube	< 0.2	1 - 8	Should be shipped on ice or equivalent; refrigerate upon receipt.	30 Days	IH Refrigerator in SVOA Lab
	3M (Modified)	3M Badge (3500 or 3520)	0.0314	8 Hrs Max.	Should be shipped on ice or equivalent; refrigerate upon receipt.	3 Weeks	IH Refrigerator in SVOA Lab
	SKC (Modified)	SKC 575-002 Passive Badge	0.0149	8 Hrs Max.	Should be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
	Assay Technology(Mod)	Assay N541 or N546 Badge	0.00380 (#541) 0.00095 (#546)	8 Hrs Max.	Should be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
Toluene-2,4-Diisocyanate (2,4-TDI)	OSHA 42	37-mm Glass Fiber Filter coated with 1,2PP	1 L/min	15	Should be shipped on ice or equivalent; refrigerate upon receipt.	18 Days	IH Refrigerator in SVOA Lab
Toluene-2,6-Diisocyanate (2,6-TDI)	OSHA 42	37-mm Glass Fiber Filter coated with 1,2PP	1 L/min	15	Should be shipped on ice or equivalent; refrigerate upon receipt.	18 Days	IH Refrigerator in SVOA Lab
Toxaphene	NIOSH 5039	37-mm, 0.8-um, MCE Filter	0.2 - 1	2 - 30	Should be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
1,1,1-Trichloroethane	NIOSH 1003	150-mg Charcoal Tube	0.01 - 0.2	0.1 - 8	May be shipped on ice or equivalent; refrigerate upon receipt.	30 Days	IH Refrigerator in SVOA Lab
	3M (Modified)	3M Badge (3500 or 3520)	0.0309	8 Hrs Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	21 Days	IH Refrigerator in SVOA Lab
	SKC (Modified)	SKC 575-002 Passive Monitor	0.0141	8 Hrs Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
	Assay Technology(Mod)	Assay N541 or N546 Badge	0.00432 (#541) 0.00159 (#546)	8 Hrs Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab

Industrial Hygiene Sample Receiving Guide

Analyte	Method Reference	Sample Media	Sampling Rate (Liters/Minute)	Air Volume (Liters)	Preservation	Sample Stability	Sample Storage
1,1,2-Trichloroethane	NIOSH 1003	150-mg Charcoal Tube	0.01 - 0.2	2 - 60	May be shipped on ice or equivalent; refrigerate upon receipt.	30 Days	IH Refrigerator in SVOA Lab
	3M (Modified)	3M Badge (3500 or 3520)	0.0297	8 Hrs Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
	SKC (Modified)	SKC 575-002 Passive Monitor	0.0125	8 Hrs Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
	Assay Technology(Mod)	Assay N541 or N546 Badge	0.00436 (#541) 0.00160 (#546)	8 Hrs Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
Trichloroethylene	NIOSH 1022	150-mg Charcoal Tube	0.01 - 0.2	1 - 30	May be shipped on ice or equivalent; refrigerate upon receipt.	17 Days	IH Refrigerator in SVOA Lab
	3M (Modified)	3M Badge (3500 or 3520)	0.0311	8 Hrs Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
	SKC (Modified)	SKC 575-002 Passive Badge	0.0143	4 Hrs Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
	Assay Technology(Mod)	Assay N541 or N546 Badge	0.00435 (#541) 0.00109 (#546)	8 Hrs Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
Valeraldehyde	Assay Technology(Mod)	AT N571 Passive Badge	0.00601 L/min	8 Hrs	Should be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
Vanadium	NIOSH 7300	37-mm, 0.8-um, MCE Filter	1 - 4	20 - 2000	Should be stored at room temperature.	Indefinite	Counter in Metal Lab Digestion Room
Vinyl Acetate	3M (Modified)	3M Badge (3500 or 3520)	0.0358	8 Hrs Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	21 Days	IH Refrigerator in SVOA Lab
	SKC (Modified)	SKC 575-002 Passive Badge	0.0163	8 Hrs Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
	Assay Technology(Mod)	Assay N541 or N546 Badge	0.00448 (#541) 0.00112 (#546)	8 Hrs Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
Vinyl Chloride	NIOSH 1007	(2) 150-mg Charcoal Tubes in Series	0.05	0.7 - 5	May be shipped on ice or equivalent; refrigerate upon receipt.	10 Days	IH Refrigerator in SVOA Lab
Vinylidene Chloride	NIOSH 1015	150-mg Charcoal Tube	0.01 - 0.2	2.5 - 7	May be shipped on ice or equivalent; refrigerate upon receipt.	21 Days	IH Refrigerator in SVOA Lab
	3M (Modified)	3M Badge (3500 or 3520)	0.0351	8 Hrs Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
	SKC (Modified)	SKC 575-002 Passive Badge	0.0123	8 Hrs Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
	Assay Technology(Mod)	Assay N541 or N546 Badge	0.00609 (#541) 0.00152 (#546)	8 Hrs Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
Xylene isomers	NIOSH 1501	150-mg Charcoal Tube	< 0.2	2 - 23	May be shipped on ice or equivalent; refrigerate upon receipt.	30 Days	IH Refrigerator in SVOA Lab
	3M (Modified)	3M Badge (3500 or 3520)	0.0273	8 Hrs Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	3 Weeks	IH Refrigerator in SVOA Lab
	SKC (Modified)	SKC 575-002 Passive Monitor	Isomer specific	8 Hrs Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
	Assay Technology(Mod)	Assay N541 or N546 Badge	0.00370 (#541) 0.00093 (#546)	8 Hrs Max.	May be shipped on ice or equivalent; refrigerate upon receipt.	14 Days	IH Refrigerator in SVOA Lab
Zinc	N7300/OSHA ID-121	37-mm, 0.8-um, MCE Filter	1 - 4	5 - 960/5 - 200	Should be stored at room temperature.	Indefinite	Counter in Metals Lab Digestion Room

Appendix 4. Arizona Certificate (PHX-QA-052/C-06/07)



Arizona Department of Health Services

ENVIRONMENTAL LABORATORY LICENSE

Issued to:

Laboratory Director: **Robert Woods**
Owner/Representative: **Rachel Brydon Jannetta**

Aerotech Environmental Laboratories
AZ0610

is in compliance with Environmental Laboratory's applicable standards for the State of Arizona and maintains on file a List of Parameters for which the laboratory is certified to perform analysis.

PERIOD OF LICENSURE FROM: 06/10/2007 TO: 06/09/2008

GREAT SEAL OF THE STATE OF ARIZONA 1912

Steven D. Baker, Chief
Office of Laboratory Services
Bureau of State Laboratory Services

Appendix 5. Arizona List of Licensed Parameters (PHX-QA-053/F-07/07)

Arizona Department of Health Services
Office of Laboratory Licensure, Certification & Training
250 North 17th Avenue, Phoenix, AZ 85007

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Thursday, July 19 2007

AZ License: AZ0610

Lab Director: Mr. Robert Woods

Lab Name: Aerotech Environmental Laboratories
Phone: (602) 437-3340
Fax: (623) 445-6192

Program AIR

Parameter	EPA Method	Billing Code	Cert Date
Volatile Organic Compounds	METHOD TO-15	AIR17	02/26/01

Total Licensed Parameters in this Program: 1

Program HW

Parameter	EPA Method	Billing Code	Cert Date
Alumina Cleanup	EPA 3610B	PREP2	11/03/99
Aluminum	EPA 6010B	MTL3	11/03/99
Aluminum	EPA 6020	MTL7	11/24/03
Antimony	EPA 6010B	MTL3	11/03/99
Antimony	EPA 6020	MTL7	11/24/03
Arsenic	EPA 6010B	MTL3	11/03/99
Arsenic	EPA 6020	MTL7	11/24/03
Barium	EPA 6010B	MTL3	11/03/99
Barium	EPA 6020	MTL7	11/24/03
Beryllium	EPA 6010B	MTL3	11/03/99
Beryllium	EPA 6020	MTL7	11/24/03
C10-C32 Hydrocarbons	8015AZ1	VOC4	12/05/06
Cadmium	EPA 6010B	MTL3	11/03/99
Cadmium	EPA 6020	MTL7	11/24/03
Calcium	EPA 6010B	MTL3	11/03/99
Chlorin. Herbs By Gc Methylation	EPA 8151A	SOC3	11/03/99
Chromium Total	EPA 6010B	MTL3	11/03/99
Chromium Total	EPA 6020	MTL7	11/24/03
Closed System Purge And Trap Extract. Vocs	EPA 5035A	PREP2	12/05/06
Cobalt	EPA 6010B	MTL3	11/03/99
Cobalt	EPA 6020	MTL7	11/24/03
Continious Liquid-Liquid Extraction	EPA 3520C	PREP2	05/21/01
Copper	EPA 6010B	MTL3	11/03/99
Copper	EPA 6020	MTL7	11/24/03
Corrosivity Ph Determination	EPA 9040C	HAZ1	12/05/06
Cyanide	EPA 9010C	PREP2	12/05/06
Cyanide	EPA 9014	MISC7	05/11/00
Cyanide Extractions For Solids And Oils	EPA 9013A	PREP3	12/05/06
Dissolved In Water	EPA 3005A	PREP1	11/03/99
Flashpoint Determination	EPA 1030	HAZ2	10/18/04
Hydrogen Ion (Ph)	EPA 9045D	NIA6	12/05/06
Ignitability (Flash Point)	EPA 1010A	HAZ2	12/05/06
Iron	EPA 6010B	MTL3	11/03/99
Lead	EPA 6010B	MTL3	11/03/99

Arizona Department of Health Services
Office of Laboratory Licensure, Certification & Training
250 North 17th Avenue, Phoenix, AZ 85007

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AZ License: AZ0610 **Lab Name: Aerotech Environmental Laboratories**

Program HW

Parameter	EPA Method	Billing Code	Cert Date
Lead	EPA 6020	MTL7	11/24/03
Magnesium	EPA 6010B	MTL3	11/03/99
Manganese	EPA 6010B	MTL3	11/03/99
Manganese	EPA 6020	MTL7	11/24/03
Mercury	EPA 7470A	MTL5	11/03/99
Mercury	EPA 7471A	MTL5	11/03/99
Molybdenum	EPA 6010B	MTL3	11/03/99
Nickel	EPA 6010B	MTL3	11/03/99
Nickel	EPA 6020	MTL7	11/24/03
Oil & Grease &Petroleum Hydrocarbons	EPA 1664A	MISC6	12/05/06
Organochlorine Pesticides By Gc	EPA 8081A	SOC9	11/03/99
Organophosphorus Pesticides By Gc	EPA 8141A	SOC10	05/11/00
Pahs	EPA 8310	SOC13	11/03/99
Paint Filter Liquids Test	EPA 9095B	MISC18	12/05/06
Pcbs By Gc	EPA 8082	SOC9	11/03/99
Perchlorate	EPA 314.0	NIB5	12/21/05
Potassium	EPA 6010B	MTL3	11/03/99
Pressurized Fluid Extraction	EPA 3545	PREP2	11/03/99
Purge And Trap For Aqueous Samples	EPA 5030C	PREP2	12/05/06
Sediments, Sludges And Soils	EPA 3050B	PREP1	11/03/99
Selenium	EPA 6010B	MTL3	11/03/99
Semivolatile Compounds By Gc/Ms	EPA 8270C	SOC16	03/21/00
Separatory Funnel Liquid-Liquid Extraction	EPA 3510C	PREP2	11/03/99
Silca Gel Cleanup	EPA 3630C	PREP2	11/03/99
Silver	EPA 6010B	MTL3	11/03/99
Silver	EPA 6020	MTL7	11/24/03
Sodium	EPA 6010B	MTL3	11/03/99
Splp	EPA 1312	HAZ6	11/03/99
Strontium	EPA 6010B	MTL3	11/03/99
Sulfur Cleanup	EPA 3660B	PREP2	11/03/09
Sulfuric Acid/Permanganate Cleanup	EPA 3665A	PREP2	11/03/99
Tclp	EPA 1311	HAZ5	11/03/99
Thallium	EPA 6010B	MTL3	11/03/99
Thallium	EPA 6020	MTL7	11/24/03
Tin	EPA 6010B	MTL3	11/03/99
Tocs	EPA 9060A	MISC2	05/14/07
Total Chlorine In Petroleum Products	EPA 9077	NIA2	11/03/99
Total Metals	EPA 3010A	PREP1	11/03/99
Total Recoverable In Water	EPA 3005A	PREP1	11/03/99
Ultrasonic Extraction	EPA 3550B	PREP2	11/03/99
Vanadium	EPA 6010B	MTL3	11/03/99

Arizona Department of Health Services
Office of Laboratory Licensure, Certification & Training
250 North 17th Avenue, Phoenix, AZ 85007

Thursday, July 19 2007

AZ License: AZ0610 **Lab Name: Aerotech Environmental Laboratories**

Program HW

Parameter	EPA Method	Billing Code	Cert Date
Vocs By Gc/Ms	EPA 8260B	VOC8	11/03/99
Waste Dilution	EPA 3580A	PREP2	11/03/99
Zinc	EPA 6010B	MTL3	11/03/99
Zinc	EPA 6020	MTL7	11/24/03

Total Licensed Parameters in this Program: 79

Program SDW

Parameter	EPA Method	Billing Code	Cert Date
Alkalinity	SM 2320B	NIA1	11/03/99
Aluminum	EPA 200.7	MTL3	11/03/99
Aluminum	EPA 200.8	MTL7	06/03/03
Antimony	EPA 200.8	MTL7	04/03/03
Arsenic	EPA 200.8	MTL7	04/03/03
Barium	EPA 200.7	MTL3	11/03/99
Barium	EPA 200.8	MTL7	04/03/03
Beryllium	EPA 200.7	MTL3	11/03/99
Beryllium	EPA 200.8	MTL7	04/03/03
Cadmium	EPA 200.7	MTL3	11/03/99
Cadmium	EPA 200.8	MTL7	04/03/03
Calcium	EPA 200.7	MTL3	11/03/99
Carbon, Dissolved Organic	SM 5310B	MISC1	05/14/07
Carbon, Total Organic	SM 5310B	MISC1	05/14/07
Chloride	EPA 300.0	NIIIA1	11/03/99
Chlorine Total Residual	HACH 8167	NIA3	11/03/99
Chromium Total	EPA 200.7	MTL3	11/03/99
Chromium Total	EPA 200.8	MTL7	04/03/03
Copper	EPA 200.7	MTL3	11/03/99
Copper	EPA 200.8	MTL7	04/03/03
Corrosivity	SM 2330B	NIA5	11/03/99
Cyanide	SM 4500 CN E	MISC7	11/03/99
Cyanide Amenable To Chlorination	SM 4500-CN G	MISC7	11/03/99
Fecal Coliform	SM 9221E	MIC5	02/07/01
Fecal Coliform	SM 9222D	MIC5	03/09/04
Fluoride	EPA 300.0	NIIIA1	11/03/99
Hardness	EPA 200.7, CA&MG	MTL3	12/06/02
Heterotrophic Bacteria	SIMPLATE	MIC9	11/21/05
Heterotrophic Plate Count	SM 9215B	MIC9	05/11/00
Hydrogen Ion (Ph)	SM 4500-H B	NIA6	12/05/06
Iron	EPA 200.7	MTL3	11/03/99
Lead	EPA 200.8	MTL7	04/03/03
Magnesium	EPA 200.7	MTL3	11/03/99

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Office of Laboratory Licensure, Certification & Training
250 North 17th Avenue, Phoenix, AZ 85007

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AZ License: AZ0610 **Lab Name: Aerotech Environmental Laboratories**

Program SDW

Parameter	EPA Method	Billing Code	Cert Date
Manganese	EPA 200.7	MTL3	11/03/99
Manganese	EPA 200.8	MTL7	04/03/03
Mercury	EPA 245.1	MTL5	11/03/99
Nickel	EPA 200.7	MTL3	11/03/99
Nickel	EPA 200.8	MTL7	04/03/03
Nitrate	EPA 300.0	NIIIA1	11/03/99
Nitrite	EPA 300.0	NIIIA1	04/01/02
Nitrite	SM 4500-NO2 B	NIIB4	11/03/96
Orthophosphate	EPA 300.0	NIIIA1	09/01/05
Orthophosphate	SM 4500-P E	NIIB5	05/11/00
Perchlorate	EPA 314.0	NIB5	12/21/05
Residue, Filterable (Tds)	SM 2540C	NIIA8	12/05/06
Selenium	EPA 200.8	MTL7	04/03/03
Silica	EPA 200.7	MTL3	11/03/99
Silver	EPA 200.7	MTL3	11/03/99
Silver	EPA 200.8	MTL7	04/03/03
Sodium	EPA 200.7	MTL3	11/03/99
Specific Conductance	SM 2510B	NIA7	11/03/99
Strontium	EPA 200.7	MTL3	11/03/99
Sulfate	EPA 300.0	NIIIA1	11/03/99
Temperature	SM 2550	NIA18	12/05/06
Thallium	EPA 200.8	MTL7	04/03/03
Total Coliforms And E. Coli By Colilert	SM 9223B	MIC3	11/03/99
Total Coliforms By Mf	SM 9221B & C	MIC1	02/07/01
Turbidity, Ntu: Nephelometric	EPA 180.1	NIA9	11/03/99
Vocs By Gc-Ms	EPA 524.2	VOC1	11/03/99
Zinc	EPA 200.7	MTL3	11/03/99
Zinc	EPA 200.8	MTL7	04/03/03

Total Licensed Parameters in this Program: 61

Program WW

Parameter	EPA Method	Billing Code	Cert Date
Alkalinity, Total	SM 2320B	NIA1	11/03/99
Aluminum	EPA 200.7	MTL3	11/03/99
Aluminum	EPA 200.8	MTL7	06/10/03
Ammonia	SM 4500-NH3 D	NIIB1	12/05/06
Antimony	EPA 200.7	MTL3	11/03/99
Antimony	EPA 200.8	MTL7	04/03/03
Arsenic	EPA 200.7	MTL3	11/03/99
Arsenic	EPA 200.8	MTL7	04/03/03
Barium	EPA 200.7	MTL3	11/03/99

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AZ License: AZ0610 **Lab Name: Aerotech Environmental Laboratories**

Program WW

Parameter	EPA Method	Billing Code	Cert Date
Barium	EPA 200.8	MTL7	04/03/03
Base/Neutrals And Acids Excluding Pesticides	EPA 625	SOC16	05/08/00
Beryllium	EPA 200.7	MTL3	11/03/99
Beryllium	EPA 200.8	MTL7	04/03/03
Biochemical Oxygen Demand	SM 5210B	DEM1	07/21/00
Boron	EPA 200.7	MTL3	11/03/99
Bromide	EPA 300.0	NIIIA1	11/03/99
Cadmium	EPA 200.7	MTL3	11/03/99
Cadmium	EPA 200.8	MTL7	04/03/03
Calcium	EPA 200.7	MTL3	11/03/99
Chemical Oxygen Demand	SM 5220D	DEM2	01/28/02
Chloride	EPA 300.0	NIIIA1	11/03/99
Chlorine Residual Total	HACH 8167	NIA3	04/03/03
Chromium Total	EPA 200.7	MTL3	11/03/99
Chromium Total	EPA 200.8	MTL7	04/03/03
Chromium, Hexavalent	SM 3500-CR D	MTL8	11/03/99
Cobalt	EPA 200.7	MTL3	11/03/99
Cobalt	EPA 200.8	MTL7	04/03/03
Copper	EPA 200.7	MTL3	11/03/99
Copper	EPA 200.8	MTL7	04/03/03
Cyanide Amenable To Chlorination	SM 4500-CN G	MISC7	11/03/99
Cyanide, Total	SM 4500-CN BC	MISC34	11/03/99
E. Coli By Colilert Mpn	SM 9223B	MIC3	07/11/07
E. Coli (Not For Npdes) In Conjunction	SM 9221F	MIC3	09/07/05
Fecal Coliforms By Membrane Filter	SM 9222D	MIC6	11/03/99
Fecal Coliforms By Mtf (May Be Used For Sludge)	SM 9221E	MIC5	08/06/03
Fluoride	EPA 300.0	NIIIA1	11/03/99
Hardness	EPA 200.7	MTL3	12/06/02
Hydrogen Ion (Ph)	SM 4500-H B	NIA6	01/11/05
Iron	EPA 200.7	MTL3	11/03/99
Kjeldahl Nitrogen	SM 4500-NH3 E	NIIB3	05/15/07
Lead	EPA 200.7	MTL3	11/03/99
Lead	EPA 200.8	MTL7	04/03/03
Lithium	EPA 200.7	MTL3	06/10/03
Magnesium	EPA 200.7	MTL3	11/03/99
Manganese	EPA 200.7	MTL3	11/03/99
Manganese	EPA 200.8	MTL7	04/03/03
Mercury	EPA 245.1	MTL5	11/03/99
Molybdenum	EPA 200.7	MTL3	11/03/99
Molybdenum	EPA 200.8	MTL7	04/03/03
Nickel	EPA 200.7	MTL3	11/03/99

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Office of Laboratory Licensure, Certification & Training
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Thursday, July 19 2007

AZ License: AZ0610 **Lab Name: Aerotech Environmental Laboratories**

Program WW

Parameter	EPA Method	Billing Code	Cert Date
Nickel	EPA 200.8	MTL7	04/03/03
Nitrate	EPA 300.0	NIIIA1	11/03/99
Nitrite (As N)	EPA 300.0	NIIIA1	04/01/02
Nitrite (As N)	SM 4500-NO2 B	NIIB4	11/03/99
Oil And Grease	EPA 1664A	MISC6	12/05/06
Organochlorine Pesticides And Polychlorinated Biphenyls	EPA 608	SOC9	11/04/99
Organophosphorus Pesticides	EPA 1657	SOC10	11/07/00
Orthophosphate	EPA 300.0	NIIIA1	09/01/05
Orthophosphate	SM 4500-P E	NIIB5	05/11/00
Phosphorus Total	SM 4500-P B	NIIB6	05/11/00
Phosphorus Total	SM 4500-P E	NIIB6	01/28/05
Potassium	EPA 200.7	MTL3	11/04/99
Purgeables	EPA 624	VOC8	11/04/99
Residue Filterable	SM 2540C	NIA8	11/04/99
Residue Nonfilterable	SM 2540D	NIIA5	12/05/06
Residue Total	SM 2540B	NIIA4	12/05/06
Residue Volatile	EPA 160.4	NIIA7	11/04/99
Residue, Settleable Solids	SM 2540F	NIIA6	12/05/06
Selenium	EPA 200.7	MTL3	11/04/99
Selenium	EPA 200.8	MTL7	04/03/03
Silica, Dissolved	EPA 200.7	MTL3	11/04/99
Silver	EPA 200.7	MTL3	11/04/99
Silver	EPA 200.8	MTL7	04/03/03
Sodium	EPA 200.7	MTL3	11/04/99
Specific Conductance	SM 2510B	NIA7	11/04/99
Strontium	EPA 200.7	MTL3	11/04/99
Sulfate	EPA 300.0	NIIIA1	11/04/99
Sulfide	SM 4500-S D	MISC11	11/04/99
Temperature, Degrees Celcius	SM 2550B	NIA18	05/11/00
Thallium	EPA 200.7	MTL3	11/04/99
Thallium	EPA 200.8	MTL7	04/03/03
Tin	EPA 200.7	MTL3	11/04/99
Total Coliforms By Mtf	SM 9221B	MIC1	05/11/00
Total Organic Carbon	SM 5310B	MISC1	05/11/07
Total, Fixed And Volatile Solids In Sludge	SM 2540G	NIIA7	09/29/03
Turbidity	EPA 180.1	NIA9	11/04/99
Vanadium	EPA 200.7	MTL3	11/04/99
Vanadium	EPA 200.8	MTL7	04/03/03
Zinc	EPA 200.7	MTL3	11/04/99
Zinc	EPA 200.8	MTL7	04/03/03

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Office of Laboratory Licensure, Certification & Training
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Thursday, July 19 2007

AZ License: AZ0610 **Lab Name: Aerotech Environmental Laboratories**

Program WW

Parameter	EPA Method	Billing Code	Cert Date

Total Licensed Parameters in this Program: 90

Instruments	Quantity	Date
GAS CHROMATOGRAPH/MASS SPECTROMETER	8	04/21/06
GAS CHROMATOGRAPH	7	05/13/07
ION CHROMATOGRAPH	3	05/16/02
HIGH PERFORMANCE LIQUID CHROMATOGRAPH	2	05/16/02
AUTOMATED AUTOANALYZER	2	05/13/07
INDUCTIVELY COUPLED PLASMA SPECTROMETER	2	04/21/06
INDUCTIVELY COUPLED PLASMA/MASS SPECTROMETER	1	05/22/03
MERCURY ANALYZER	1	11/04/99

Softwares
ENVIROQUANT - GCMS
MILLENNIUM CHROMATOGRAPHY MANAGER - HPLC
PERKIN ELMER - ICP
PERKIN ELMER - ICP/MS
CHROMELEON (DIONEX) - IC
CHEMSTATION - GC/MS
1-FIMS - MERCURY ANALYZER
ENVIROQUANT/CHEMSTATION GC/MS
MANTECH

Appendix 6. AIHA Certificate (PHX-QA-054/B-06/07

AIHA

Protecting Worker Health

The American Industrial Hygiene Association

acknowledges that

Aerotech Environmental Laboratories

4645 East Cotton Center Boulevard, Building 3, Suite 189, Phoenix, AZ 85040-8874

Laboratory ID: 154268

has fulfilled the requirements of the AIHA Laboratory Quality Assurance Programs (LQAP), thereby, conforming to the ISO/IEC 17025:2005 international standard, *General Requirements for the Competence of Testing and Calibration Laboratories*. The above named laboratory, along with all premises from which key activities are performed, as listed above, have been accredited by AIHA in the following:

ACCREDITATION PROGRAMS

✓	**INDUSTRIAL HYGIENE**	Accreditation Expires: 07/01/2009
☐	**ENVIRONMENTAL LEAD**	Accreditation Expires:
☐	**ENVIRONMENTAL MICROBIOLOGY**	Accreditation Expires:
☐	**FOOD**	Accreditation Expires:

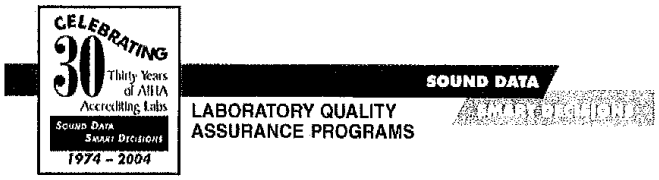
Specific Field(s) of Testing (FoT)/Method(s) within each Accreditation Program for which the above named laboratory maintains accreditation is outlined on the attached **Scope of Accreditation**. Continued accreditation is contingent upon successful on-going compliance with LQAP requirements. This certificate is not valid without the attached **Scope of Accreditation**. Please review the AIHA website for the most current status of the scope of accreditation.

James A. Kenny, CIH, CSP
Chairperson, Analytical Accreditation Board

Donald J. Hart, PhD, CIH
President, AIHA

Date Issued: 06/27/2007

Appendix 7. AIHA Scope of Accreditation (PHX-QA-055/C-08/07)



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Your Essential Connection: Advancing Occupational and Environmental Health and Safety Globally
2700 Prosperity Ave., Suite 250, Fairfax, VA 22031 U.S.A.
(703) 849-8888; Fax (703) 207-3561; www.aiha.org

AIHA Laboratory Quality Assurance Programs
SCOPE OF ACCREDITATION

Aerotech Environmental Laboratories
4645 East Cotton Center Boulevard, Building 3, Suite 189, Phoenix, AZ 85040-8874

Laboratory ID: 154268
Issue Date: 07/30/2007

The laboratory is approved for those specific field(s) of testing/methods listed in the table below. Clients are urged to verify the laboratory's current accreditation status for the particular field(s) of testing/Methods, since these can change due to proficiency status, suspension and/or revocation. A complete listing of currently accredited Industrial Hygiene laboratories is available on the AIHA website at:
http://www.aiha.org/Content/LQAP/accred/AccreditedLabs.htm

Industrial Hygiene Laboratory Accreditation Program (IHLAP)

Initial Accreditation Date: 08/01/2002

IHLAP Category	Field of Testing (FoT)	Method	Method Description *(for internal methods only)*
Core Program Testing	**Gas Chromatography**	NIOSH 1003	
		NIOSH 1005	
		NIOSH 1007	
		NIOSH 1010	
		NIOSH 1015	
		NIOSH 1022	
		NIOSH 1300	
		NIOSH 1400	
		NIOSH 1401	
		NIOSH 1403	
		NIOSH 1405	

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IHLAP Category	Field of Testing (FoT)	Method	Method Description (*for internal methods only*)
Core Program Testing (continued)	**Gas Chromatography (continued)**	NIOSH 1450	
		NIOSH 1457	
		NIOSH 1500	
		NIOSH 1501	
		NIOSH 1550	
		NIOSH 1602	
		NIOSH 1604	
		NIOSH 1606	
		NIOSH 1609	
		NIOSH 1611	
		NIOSH 1613	
		NIOSH 1615	
		NIOSH 2000	
		NIOSH 2546	
		NIOSH 2551	
		NIOSH 5503	
		NIOSH 5600	
		OSHA 07	

IHLAP Category	Field of Testing (FoT)	Method	Method Description (*for internal methods only*)
Core Program Testing (continued)	**Gas Chromatography (continued)**	OSHA 1004	
		OSHA 48	
		OSHA 69	
	Gas Chromatography – Diffusive Samplers	3M Validation Reports and Sampling Information	
		Assay Technology Validation Reports and Sampling Information	
		SKC Validation Reports and Sampling Information	
		OSHA 07	
		OSHA 111	
		OSHA 1001	
		OSHA 1002	
		OSHA 1004	
		OSHA 1005	
	GC/MS	NIOSH 1003	
		NIOSH 1501	
	HPLC	Assay Technology Validation Reports and Sampling Information	
		EPA TO-11	
		NIOSH 2016	
		NIOSH 2532	
		NIOSH 5506	

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IHLAP Category	Field of Testing (FoT)	Method	Method Description (*for internal methods only*)
Core Program Testing (continued)	**Gas Chromatography (continued)**	OSHA 1004	
		OSHA 48	
		OSHA 69	
	Gas Chromatography – Diffusive Samplers	3M Validation Reports and Sampling Information	
		Assay Technology Validation Reports and Sampling Information	
		SKC Validation Reports and Sampling Information	
		OSHA 07	
		OSHA 111	
		OSHA 1001	
		OSHA 1002	
		OSHA 1004	
		OSHA 1005	
	GC/MS	NIOSH 1003	
		NIOSH 1501	
	HPLC	Assay Technology Validation Reports and Sampling Information	
		EPA TO-11	
		NIOSH 2016	
		NIOSH 2532	
		NIOSH 5506	

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IHLAP Category	Field of Testing (FoT)	Method	Method Description *(for internal methods only)*
	HPLC (continued)	OSHA 42	
		OSHA 47	
		OSHA 64	
	AA	NIOSH 6009	
		OSHA ID-140	
	ICP	NIOSH 6001	
		NIOSH 6006	
		NIOSH 7300	
		OSHA 1003	
		OSHA ID-121	
		OSHA CSI for Silicon Tetrahydride	
	Ion Chromatography	NIOSH 7903	
	ICP	NIOSH 6001	
		NIOSH 6006	
		NIOSH 7300	
		OSHA 1003	
		OSHA CSI for Silicon Tetrahydride	
	Gravimetric	NIOSH 0500	
		NIOSH 0600	
		NIOSH 5000	
	UV/VIS (Colorimetric)	NIOSH 6010	
		NIOSH 7600	
	IR	NIOSH 5026	

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The laboratory participates in the following AIHA* or AIHA-approved proficiency testing programs:

- ✓ Metals*
- ❑ Silica*
- ❑ Asbestos*
- ❑ Bulk Asbestos*
- ❑ Beryllium*
- ✓ Organic Solvents*
- ✓ Diffusive Sampler (3M)*
- ❑ Diffusive Sampler (SKC)*
- ❑ Diffusive Sampler (AT)*
- ✓ WASP[1] (Formaldehyde)
- ❑ WASP[1] (Thermal Desorption Tubes)
- ❑ Pharmaceutical Round Robin
- ❑ Compressed/Breathing Air Round Robin
- ❑ NVLAP (determined at the time of site assessment)

[1] Workplace Analytical Scheme for Proficiency